THE
DIARY COMPANION;

BEING A

SUPPLEMENT

TO THE

LADIES' DIARY,

FOR THE YEAR 1796.

Containing Answers to the last Year's ENIGMAS, REBUSES, CHARADES, QUERIES, and QUESTIONS; both in the DIARY and SUPPLEMENT

With some New ENIGMAS, REBUSES, CHARADES, QUERIES, and QUESTIONS, proposed to be answered next Year.

Also, CALCULATIONS of the ECLIPSES; and other New Discoveries in the Heavens.

By the DIARY AUTHOR.

SUPPLEMENT

TO THE

LADIES' DIARY,

FOR THE YEAR 1796.

ANSWERS TO THE ENIGMAS.

1. *Diary Enigmas.*

1	Cradle,	6	Pulpit,
2	Eve,	7	Lips,
3	Thimble,	8	Air,
4	Bridge,	9	Coals,
5	Nail,	10	Knot.

2. *Supplement Enigmas.*

1	Juſtice,	5	Smile,
2	Wedding Ring,	6	Match,
3	W,	7	Printing Preſs,
4	Woman,	8	Cork.

*Other Anſwers to the Diary Prize Enigma, beſide thoſe in-
ſerted in the Diary, are as below.*

12. *Addreſs to Miſs Nancy Maſon, of Clapham; by the
Rev. Mr. Ewbank, of Thornton-Steward.*

What you, Ma'am, have perform'd, I 've with wonder read o'er,
And am ſtill more ſurpriz'd, when your age* I explore.——
O'er the mountain call'd Cam, I have yet never been,
Although cloud-capt, and ſnow-capt, the ſame I have ſeen—
But if e'er I ſhould croſs it, and Clapham come nigh,
To find your abode, Ma'am, I purpoſe to try;
For I like to converſe with ſuch ladies as you,
And of ſuch a deſcription I can but find few.——
On the verge of your wedding, ſhould fate throw the lot,
When I call, let me ſtay, and for you tie the *Knot.*

* Aged only 21 years, 11 months, 7 days. Jan. 1, 1795.

13. *Ode to Solitude; by Mr. O. G. Gregory, of Yaxley,
Hunts.*

Oh Solitude! calm contemplation's nurſe,
    And of reflection keen the conſtant friend;
Wand'ring with thee, my ſorrows I'll rehearſe,
    With thee in grief the dreary hours I'll ſpend.

From ſcorching heat of Summer's mid-day ſun,
    Let me with thee on tufted graſs recline,
Under the ſhade of ſome tall *Knot*ted pine,
Where at my feet a brook's hoarſe murmurs run.

And when pale Luna sheds her gentle light,
To me congenial is thy gloomy grove,
Where the dry leaves in rustling order move,
And shriek-owls scream more dismal makes the night.
There shall my troubled breast with anguish heave,
Alas! my Anna's dead—and I—am left to grieve.

14. *Address to Hermes; by Lepidus.*

The hidden meaning anxious to explore,
In vain I read thy polish'd verses o'er:
But when—" the God in saffron robe" descended,
My pleasing task, at once, was quickly ended.
Friend Horace kindly made this precept known,
" Bring in the Gods in *Knot*ty points alone *."

* *Vide Hor. Art. Poet. v.* 191.

Nec Deus intersit, nisi dignus vindice *Nodus*
Inciderit ————

15. *The same, by Rusticus, of Mitcham, Surry.*

When Hymen and Love, sirs, are cordially join'd,
The *Knot* which they tie is a tight one;
And that, our friend Hermes had artfully twin'd,
Was not I assure you a slight one;
For so many false guesses incumber'd my mind,
'Twas long ere I hit on the right one.

16. *To Peace; by Mr. W. Watts, Penzance.*

Come, Peace, return with balmy wing,
And every blessing with thee bring;
Make Commerce lift her drooping head,
And plenty through our borders spread.

Bid the loud cannon cease to roar,
The din of war be heard no more,
Nor human blood in vain be spilt,
That buries nations deep in guilt.

Bid nation against nation cease
To wield the sword; but join in Peace;
Bid friendship's *Knot* so firm abide,
That it may never be untied.

17. *By Mr. Tho. Woolston; addressed to a young Gentleman engaged in the study of the Belles Lettres, but who had tried in vain to find out the Prize Enigma.*

Would you the pleasing paths of hist'ry tread,
And view the actions of the mighty dead;
While you advert to deeds of ancient days,
Might I direct;—or give an author praise;—
Rollin's chaste page, in short, the best can tell
How empires, fam'd of old, arose and fell;

How Alexander, by ambition fir'd,
To univerfal monarchy afpir'd:
You there may read;—and there may be defcry'd,
'Twas he, the famous Gordian *Knot* untied.

Other ANSWERS *to the* DIARY ENIGMAS, *befide thofe inferted in the Diary, are as follow.*

12. *On Quitting the Country, addreffed to Mr. Geo. Cook; by Mr. John Brookfbank.*

Hail! happy youth! who free from noife and ftrife,
Enjoys the pleafures of a rural life;
While I by fate am doom'd to quit thefe fcenes,
For thofe where pride and maddening folly reigns;
Scenes from my *Cradle* I've in peace enjoy'd,   1
Nor of their pleafures ever yet was cloy'd.——
How bleft the time! when I like you could rove,
At morn or *Eve* to yonder fhady grove;   2
Or elfe acrofs the *Bridge* with hafte repair,   4
To tread the meads and breathe the balmy *Air*;   8
Where trips the ruftic maid, whofe *Lips* outvie   7
The carmine's hue, or the vermilion's die;
To milk her kine that feed in yonder dale,
Not fnow more white than her clean milking-*pail*,   5
Whofe hand the ufeful *Thimble* oft doth grace,   3
And blooming rofes feem t' adorn her face;
Whofe *Coal*-black eyes than rubies are more bright,   9
And to each ruftic bofom give delight.
But I, alas! muft thefe bleft fcenes forego
For thofe made up of folly, vice and fhow;
While you at will can trip to yonder brook,
With *Knot*ted line, and a well-baited hook;   10
Or elfe acrofs the flow'ry meadows ftray,
There hail the coming, and the parting day.——
Tho' from each other we far parted are,
O, let us make the ways of God our care;
And mind the precepts from the *Pulpit* giv'n,   6
Which fhew the path that leads direct to heav'n;
Then after death, we're fure to reach that fhore,
Where from each other we fhall part no more.

13. *The Invitation; by Mifs Eliza Saul.*

Come, Celia, quit the bufy town,
    Where noife, where folly reigns;
Thy foul with milder pleafures crown,
    Here on our peaceful plains,

Where nature does her charms impart
    A thoufand different ways;
More pow'rful far than thofe of art,
    At Operas, Balls and Plays.

Here crystal streams, that smoothly flow
  Beneath the *Bridge* are seen ;   4
And vernal *Airs*, that sweetly blow   8
  Upon the verdant green.

Here warbling birds their music lend,
  And flocks and herds abound ;
Here trees with various fruits do bend ;
  All nature smiles around.

No wars or tumults here prevail,
  No tyrant's power we own ;
Which some fight for with tooth and *Nail* ;   5
  And want is here unknown.

At *Eve*, we by the cheerful fire   2
  With *Coals* well furnish'd, sit,   9
And read, or *Sew*, or *Knot* the fringe,   3, 10
  As fancy does permit.

On Sunday drest, like others, gay,
  We all to *Church* repair ;   6
Where holy *Lips* join song, and pray   7
  To him that 's worship'd there.

O'er cards no vigils late we keep,
  That rob the soul of rest ;
No *Cradle* need to lull to sleep,   1
  When with no cares opprest.

Come then, my friend, to this retreat,
  From vice, from danger free,
And make my happiness complete,
  With thy society.

14. *Mr. Tho. R. Smart's Address to Mr. I. Gumley, of Ansty.*

Far from the city's crowded scene,
In sweet retirement, calm, serene,
  How blest our days we spend ;
The purest pleasures we engage,
From *Cradle*'d infancy to age,   1
  And hail each other friend.

Oft as at *Eve* we gaily talk,   2
Or o'er the *Bridge* we nimbly walk, 4
  Inhaling nature's sweets ;   8
Unbounded prospects meet the view,
Each site presents a pleasure new,
  And with fresh rapture greets.

When winter clothes the fields with snow,
And frost forbids the streams to flow,

We feek the cheering *fire*;   9
Bleft with a pipe and glafs, we fip,
The bev'rage fparkles on the *Lip*,   7
    To her we moft admire.

Through every feafon of the year,
When labour bids, her voice we hear,
    And blythe the call obey;
This to our pleafure gives a zeft,
At night we fink to balmy reft,
    And meet the new-born day.

The leifure hour we can employ,
To fearch the ftores of Lady Di,
    And trace each hidden thought;
The charms of *Pulpit* paint with eafe,   6
Ev'n *Nails* delight, and *Thimbles* pleafe,   5, 3
    When folv'd the myftic *Knot*.   10

Can crowns or thrones with this compare?
Ribbons elude the fearch of care?
    Or odious paffions hufh?
Content oft flies the pomp of ftate,
Attendant at the cottage gate;
    Hear this ye great and blufh.

15. *The fame, by Mr. T. B. Smith, of Norley.*

Once happy by my *Coal* fire fide,   9
With her by nuptial *Knot* my bride,   10
I, as a bee its honey fips,
Drew nectar from her coral *Lips*:   7
While innocence upon us fmil'd,
In that dear pledge our firft-born *child*;   1
Or when we play'd with fingers nimble,
The needle guarded by a *Thimble*;   3
Or when fhe had repeated o'er
Ought of the preacher's *Pulpit* lore: 6
Then fure as a faft-driven *Nail*,   5
I thought my profpects ne'er could fail.
But foon I found my loving wife,
Verging towards the *Eve* of life   2
Snatch'd from this *vital atmofphere*,   8
She left me overwhelm'd with care,
And pafs'd the *Bridge*, and gain'd the bourn,   4
From whence no travellers return.

Learn reader hence, whate'er we value moft,
Or reft our heart upon, may foon be loft.
Be then our truft in Chrift, that fo we may,
Like her afcend to realms of endlefs day.

16. On *Winter*; by Mr. *John Walton.*

Again ſtern winter, clad in robes of white,
And tardy ſol prolongs the ſhades of night ;
While northern blaſts, ſharp, pinching, keen, ſevere,
Lay waſte the blighted beauty of the year.
At hoary *Eve*, at noon ; at noon, or morn,   2
Deſtructive Boreas ſounds his dreary horn ;
And from his arctic *throne*, an *Airy* band   6, 8
Cover with ice the lake, with ſnow the land ;
Foe to the herds, to wooly flocks, and fowls,
That browſe the fields, or feed in muddy pools.
A cryſtal *Bridge* from foot to head conjoin   4
The river's brink, and makes each land our own.
The ſpreading elm, the *Knotty* ridged oak,   10
Bend to the blaſt, and ſcarce ſurvive the ſtroke ;
While mortals ſnugly ſhielded from the blaſt,
Amuſe themſelves with telling what is paſt.
Who *Cradles* uſe, how *Thimbles* fit the *Nails*,   1, 3, 5
Whoſe *Lips* are roſey, and anon it hails,   7
Who ſubſtance have, who want, what *Coal* is good,   9
When chang'd the moon, or when 's the time of flood,
Till ling'ring ſol, and gentle zephyrs play,
And cheering ſongſters hail the month of May.

17. *The Happy Peaſant*; by Mr. *T. J. Wood, Bury, Lanc.*

How bleſt am I, my cares are few,
My mind 's *not* led by faſhions new ;   10
I envy not the rich man's ſtate,
But live content in my retreat.
Soon as the ſun appears i' th' eaſt,
To daily taſk I quickly haſte ;
My ſcythe, or flail, I cheerful uſe ;
In alehouſe ne'er myſelf abuſe.
At *Eve* my ſteps I homeward bend,   2
Where ſmiling children me attend ;
And round about me as they crowd,
Expreſs their joy in accents loud.
See *Bridget* in the *Cradle* too,   4, 1
For daddy's notice ſeems to ſue,
Roſes on her ſweet *Lips* appear,   7
Shewing that ſmiling health dwells there.
My wife, as ſoon as me ſhe's ſpy'd,
Quickly her *Thimble* lays aſide ;   3
From off the *Nail* the bacon takes,   5
And o'er the *Coals* my ſupper makes ;   9
Which with good appetite I eat,
Nor ever wiſh for better meat :

When curfeu founds from diftant town,
To feek fweet fleep I lay me down ;
Nor need rich beds of down, to clofe
My drowfy eyes in foft repofe.
Each funday I to church repair,   8
From *Pulpit* a good fermon hear,   6
Nor wifh alone to hear, but do
The things which it exhorts me to.
Thus bleft, I lead a peaceful life,
Stranger to all domeftic ftrife ;
And pleafures feel in this my ftation,
For all my toil fweet compenfation.

ANSWERS *to the* PRIZE ENIGMA *in the laft* SUPPLEMENT.

1. *The State of Innocence* ; *by Mr. J. Bayley, Schoolmafter.*

How bleft was the firft pair in innecence,
When free from grief, and care, as from offence !
Then facred truth their words did always guide ;
Nature fpontaneoufly their wants fupply'd ;
They drank pure water from the cryftal ftream ;
Bottles and *Corks* both ufelefs were to them.
Supremely thus o'er all the globe they reign'd,
Till bafe ingratitude their virtue ftain'd.

2. *To Mr. Rob. Richardfon ; by Mr. John Brookfbank.*

How comes it, Richardfon, that you fo long
Seclude yourfelf from Dia's focial throng ?
When fair Diaria, with her matchlefs charms,
Impatient waits to clafp you in her arms :
You once in converfe fweet, my unknown friend,
With her a pleafing hour or two would fpend :
As light as *Cork* each fair one's heart would be,
When they again your pleafing numbers fee.

3. *The Contraft* ; *by Hermes.*

With a fmile from my amiable Cynthia bleft,
Such rapturous pleafure her fmiles can impart,
Soft tranfports delightfully thrill thro' my breaft,
And light—full as light as a *Cork* is my heart.

But whene'er in difpleafure fhe frowns on her fwain,
All my former gay vifions of rapture are fled ;
In my bofom, dark care and folicitude reign,
And my heart, my fad heart becomes heavy as lead.

4. *By Mr. G. Cook, of Everingham.*

How lucky if my youthful wit
The Supplemental Prize could hit,

And bring it quick to view !
Tho' veil'd in enigmatic lore,
A *Cork* the ſecret will explore ;
So lovely fair adieu.

5. *By Mr. John Fildes, of Liverpool.*

Hail, learned Stafford ! tuneful bard,
Thy verſes juſtly claim regard ;
For few can boaſt of art like thine,
To make a *Cork* pleaſe more than wine.

6. *The Contented Cottager ; by Miſs Eliz. Fox, of Barmby, near Howden.*

Each morning I cheerfully go to my work,
And my heart all the day is as light as a *Cork* ;
And when to my cottage at eve I repair,
I'm met with a ſmile by a good-natur'd fair.
Thus happy I live, and what more can I wiſh ?
For content gives a zeſt unto each homely diſh.

7. *The Crazy Lover's Exclamation ; by Mr. O. G. Gregory.*

—— Nay, place me where a human foot ne'er trod
The barren wilds, and where the genial ſun
On the blank face of nature never ſhone ;
Where thunder's pealing craſh tremendous rolls,
And forked lightning, vivid, flaſhes round ;
Where ugly ſprites, throughout the gloomy night,
Dance, light as *Corks*, with mad fantaſtic pace ;
Where loathſome reptiles hide the vampiſh earth,
And inconceivable horror ſits enthron'd :——
—There, in a moſs-grown cell, dug deep beneath
A barren tuſtleſs bank, where black deſpair,
Like a ſtarv'd wolf, prowls round the cheerleſs place
To gnaw the ſoul—laid on a lock of ſtraw,
And fed on roots and ſnails—in ſuch a ſtate
As man yet never liv'd in, nor conceiv'd,
Bleſs'd with my Poll I could contented be
A butt for fortune's malice, and mankind's !

8. *By Mr. William Marriot, of Neath.*

Whene'er I meet Diarian brothers,
   To treat them well I never fail ;
Rather to them than any others,
   Draw a *Cork* of good Welch ale.

9. *By Mr. Paul Meaſor.*

O Heavens ! could I but have my wiſh,
   This be my ſole deſire ;
A bottle to un*Cork* each eve,
   While ſitting by the fire ;

Together with some charming fair,
  To make my converse blest;
Adieu I then should bid to care,
  And calmly be at rest.

10. By Mr. John Rimmer, of Liverpool.

As thrice the mystic prize I read,
I 'd various objects in my head;
But none like *Cork* would suit the strain,
And Stafford's witty hints explain.

11. Acrostical Answer, by Miss P. Robertson, of Bath; occasioned by Miss Harpur's Address to Vertigo.

" *Cupid* no more shall cost this heart a sigh,"
O what a rash unkind resolve, said I.
Relief howe'er this thought to lovers brings——
Keeping and making vows, are different things."

Various other separate and ingenious answers to the Prize Enigma were also given by Betty Bays, John Browne, Geo. Clarke, Wm. Davis, Mr. Ewbank, Tho. Herod, Rd. Humber, Wm. Marriot, Ortonian, Da. Robarts, John Savage, R. W. of S, W. Watts, &c. &c.

GENERAL ANSWERS *to the* SUPP. ENIGMAS.

1. To the engaging Poetess, Madam Diaria; by Mr. John Brooksbank, of Howden, Yorkshire.

Tho' three and ninety years you 've grac'd this land,	
You on the list of fame yet *Matchless* stand;	6
O lovely *Fair one*, deign to *Smile* on me,	4, 5
A youth whose age is under twenty-three;	
Then with a heart as light as *Cork* I'll sing	8
Your praises, till the groves and valleys *Ring*;	2
Till all the *World* shall know your tow'ring fame,	3
And pay due homage to your lovely name.	
But if, in *Justice* to my boldness, you	1
Should on me frown, then I must bid adieu	
To all the joys I fancied to possess	
In you, my fair enchanting poetess.——	
But this forbid, ye pow'rs that rule above !	
For her it is whom I so dearly love;	
My ardent passion *Print* upon her mind;	7
O then to me she ever must prove kind.	

2. An Address to Miss Harper, of Seaton-Ross, by Mr. G. Cook, of Everingham.

Susan ! attend an unexperienc'd youth,	
And learn the precepts of celestial truth.	
Let meek ey'd *Justice* shield your youthful days,	1
And gild each action with her heav'nly rays.	

*W*hat tho' the graces mould your afpect meek,   3
And beauty's bloffoms paint your lovely cheek ;
Tho' *Rings* and jewels lend their artful grace,   2
And *Smiles* attractive *print* your blooming face,   5, 7
Still lovelier objects nobler worth impart,
And give more beauties to each *female* heart :   4
For, *Match*'d with thefe, each worthlefs joy muft fail, 6
And, light as *Cork*-wood mount the trembling fcale.   8
'Tis heav'n-born virtue gives your charms their force,
A train celeftial owns the facred fource !
Hence pureft joys that glad this vale below,
Love, peace, and friendfhip in fucceffion flow.
O ! court her glorious name, her heav'nly pow'rs,
And join fair virtue to a form like yours ;
Then fhall each fwain your modeft worth declare,
And hail you fairer than the faireft fair.

3. *The Blooming Bride* ; *by Mr. John Fildes.*

What true pleafure the *Smiles* of fweet *Woman* impart,   5, 4
When *Matching* for life ; light as *Cork* feems her heart ; 6, 8
When the *Ring* is put on, 'tis but *Juftice* to fay,   2, 1
That her blufhes furpafs all the rofes in May.
The fond bridegroom beholds her with tenfold delight;
And impatiently *W*aits the return of the night ;   3
Which at length being come, fuch her heavenly charms,
He unfpeakable raptures enjoys in her arms.——
Now the Editor highly will pleafe an old friend,
Should he the above to the *Printing Prefs* fend.   7

4. *The Wifh for Peace* ; *by Mr. Wm. Gofs, of Penzance.*

Ruler fupreme whofe *Juftice* ftill prefides,   1
*W*hofe power ftill *Match*lefs the creation guides ;   3, 6
See the diftracted fons of *Earth* contend,   7
And bring contention to a fpeedy end.

Averfe to *Smiles* in flaughter they engage ;   5
The thund*ring* cannon roars with vengeful rage ;   2
See carnage and deftruction fpread around,
And human blood befprinkles all the ground.

To thee, O Lord ! the nations all appear
Light as a *Cork*, or futile as the air ;   8
Be pleas'd to ftop the fpread of hu*man Wo*e,   4
And let its dire effects no farther go.

Our grateful hearts will then refound thy praife,
And celebrate thy name thro' all our days ;
The wonders thou haft done fhall be our fong,
And in the theme we will thy praife prolong.

5. *A Married Man's Address to the Votaries of Venus, by Hermes.*

Ye topers, ye bucks, and ye wine-bibbing souls,
   I address these my verses to you!
Gay transports you find in your full-flowing bowls,
   Who that sees you must own to be true.   3

But a new sort of pleasure I mean to point out
   To your notice, if you'll but attend;
A pleasure that never will bring on the gout,
   And never your stomachs offend.

I've a *Wife* (now methinks that I see you all stare,
   And ask what the blockhead can mean)   4
She is handsome indeed, but more witty than fair,
   Good-humour'd, industrious, and clean.   5

'Twas a *Match* of affection, not money;—but then, 6
   Kind Heaven indulgently sent
A competence ample, enough to maintain
   Its possessors, with little content.

Three lads, and two lasses, augmented our joys,
   (This moment I hear them at play)
Not given to brawling, contention, and noise,
   You ne'er saw a *circle* more gay.   2

With my pratlers all cheerfully seated around
   One, or more perhaps, plac'd on my knee,
My heart with a lively delight does rebound,
   To hear all their innocent glee.

One tells of the nods of his *float* in the stream, 8
   What nibbles—what fishes he caught;
Or one from a *book* culls a favourite theme,   7
   Or of *Justice* expresses his thought.   1

I now come to the question I meant to propose,
   Premising the case all along——
Delights can the bottle give equal to those?
   If you think so, I've finish'd my song.

6. *On Spring; by Jacobus, of Norwich.*

Hail, genial Sp*ring*! dispense thy *Smiles* around 2, 5
Each stately pile, and straw-roof'd cot, for all
Thy presence greet.—*Welcome* ye vernal gales,   3
That health and joy dispense to every heart.
The friendly circle on the village green,
With festive mirth and innocent delights,
Announces the return of glad'ning days:
See! light as *Cork* the youthful *Maidens* trip 4, 8
Th' enamell'd mead inur'd to sprightly dance:
While age sits *Justly* honour'd by the social throng, 1

Sharing with joy the general feſtivity.
Such are the *Matchleſs* charms of rural life,   6
Where health and calm contentment ſit enthron'd
On ev'ry brow,—fell diſcord baniſh'd thence.
Each tree now waking anew to life,
Unfolds its leaves, *teaming* with millions,——   7
Seen by the piercing philoſophic eye,
But in minuteneſs loſt to vulgar gaze.——
The tuneful choir with pleaſing melody,
In ſon'rous notes ſalute the liſt'ning ear;
Each flower ſheds around its fragrant ſcent,
And ev'ry mead in gayeſt verdure 's dreſt.——
Thus triumphs Spring, but ah how ſhort her reign!
Hot Summer ſuns ſucceed, and blaſt her joys;
Then follows Autumn, verging to decay;
While Winter with his cold and darkſome days,
Creeping with ſullen pace, ſhuts up the ſcene.
—So 'tis in life; time's in perpetual flow,
We joy in youth, in manhood reach our prime,
In old age wither as the falling leaf,
And Death inſatiate brings us to the ground.

7. *Miſs A. Maken's Addreſs to the amiable Miſs Clara* —.

Your time, my dear Clara, believe now your friend,
   Than in dreſs you might better engage;
If you with attention would deign to attend
   To the Supplement's myſtical page.
There *Juſtice* and mercy bring freſh in each mind   1, 2
   The choice bleſſings *We* Britons approve;   3
Each *Woman* there *Smiles* at the *Match* that may bind   4, 5, 6
   Her to him ſhe ſincerely can love.
Where ſubjects ſo varied muſt ſtrike your keen eyes,
   If you'll but condeſcend to peruſe;
Nor the *Preſs* nor the *Cork,* yclep'd there the prize,   7, 8
   To approve ſhall your judgment refuſe.

8. *The ſame anſwered by Mr. Alex. Rowe, of Reginnis.*

Wedlock, Double-U, Smile, Match, and *Printing-preſs,*   2,3,5,6,7
A *Cork,* or *Woman,* in attractive dreſs;   8, 4
But now ſince *Juſtice* does on earth abide,   1
Stay then with man, and be his proper guide.

9. *The Eſcape; by Mr. W. Watts, of Penzance.*

Wandring one morning in the month of May,   3, 2
   When cheerful Sol began his pleaſing race;
A gay young ſpark came *Smiling* 'long the way,   5
   And thus addreſs'd me with a modeſt face.

Faireſt of *Woman*-kind e'er grac'd the plain,   4
   Whoſe *Match*leſs beauty charms my flutt'ring breaſt,   6
Accept my love in *Juſtice* to my pain,   1
   And let my troubled heart in thee find reſt.
Bear witneſs *Earth*, and ye bright hoſts above,   or *Preſs*, 7
   " Stop Sir, ſaid I, no more your ſacred vows,
" Light as a *Cork* is all your talk of love,
   " And ſeek another damſel for your ſpouſe.

Other general and ingenious anſwers to the Supplement Enigmas were alſo given by the following ladies and gentlemen, viz. Adalina, Jas. Alderſon, John Aſhcroft, I. Bayley, Betty Boys, John Browne, Wm. Davis, T. S. Evans, J. Ewbank, John Fennell, J. Furnaſs, Wiles Hoſtman, Rd. Humber, Wm. Marriot, Ortonian, Young Painter, R. S, Eliza Saul, John Savage, &c.

ANSWERS *to the* REBUSES *and* CHARADES.

In the Diary.		In the Supplement.	
Rebuſes.	*Charades.*	*Rebuſes.*	*Charades.*
1 Bluſh	1 Roſebud	1 Roaſtbeef	1 Nightſhade
2 Rebus	2 Birdlime	2 Mary Palmer	2 Snowdrop
3 Wood	3 Bridegroom	3 Anderſon	3 Farewell
4 Woolſton	4 Goldwatch	4 Lark	4 Fireſide.

Other Anſwers to the Diary Rebuſes and Charades, beſide those inſerted in the Diary.

10. By Jacobus of Norwich.

The *Bridegroom*, and the *Bluſh*ing bride,
   Woolſton and *Wood* appear ;
She with a *Goldwatch* by her ſide,
   And *Roſebud*s in her hair.
He a fam'd bard, who writes with eaſe
   A *Rebus* or Charade,
Which never fail the fair to pleaſe,
   E'en tho' on *Birdlime* made.

11. The Rebuſes anſwer'd by M. M——e.

A *Rebus* and a *Bluſh* will ſhew
One-half of what you here would know ;
The other half will anſwer'd be,
When thus you *Wood* and *Woolſton* ſee.

12. The Diary Rebuſes and Charades anſwered by Miſs A. W. Maken.

While *Wood* with the Muſes diſports in the ſhade,
With garlands of *Roſebud*s diſplay'd round her head,
With her *Goldwatch* and jewels in ſplendid array,
I ſhrink from obſervance like ſtars in the day :
And penſively pore o'er ſome myſtical *Rebus*,
With *Bluſh*es imploring the kindneſs of Phœbus ;

But he, with the *Bridegroom*, young *Woolston*, 'tis said,
(Who lately the loving Miss *Birdlime* has wed)
So closely 's engag'd that I can't make him hear,
I shall therefore be silent till this time next year.

13. *The same answered by Musidorus.*
Sweet is the *Blush* that mantles on the cheek
Of lovely *Wood*; nor from the parent stalk
The *Rosebud* peeping, boasts so bright a hue
As her vermilion lip : soon may her charms
Some youthful *Bridegroom* bless!—Thine is the meed
Ingenious *Woolston* to involve in doubt
The *Rebus* winding maze : whether a *watch*
Of purest *Gold*, or *Birdlime*'s viscid pow'r
You wrap in mystic guise ; alike thy praise,
Thou favour'd priest of Dia's honour'd shrine.

14. *The Wish ; by Mr. T. R. Smart, Burton on the Wolds.*
Grant me, ye pow'rs, a rural sweet retreat,
Far from the noise and folly of the great,
Built near the margin of a murm'ring rill,
Beneath the shelter of some cloud-topt hill,
Thick fenc'd around with *Woods* that waving grow,
Where *Lime* trees flourish, and where *Rosebuds* blow.
To cheer my mind, and solace every care,
May I be *Bridegroom* to some *Blushing* fair,
Skill'd in the arts whence admiration springs,
To solve the *Rebus* happy *Woolston* sings.
From pride, ill-nature, affectation free,
One who can love—and love but only me.
No useless gems I ask, to deck my bride,
No glitt'ring *Goldwatch* to adorn her side ;
In lovely virtue rich, and native charms,
Blest I can fold her in my longing arms.

SUPPL. REBUSES *and* CHARADES ANSWERED.

1. *By Aminicus.*
As Lady Di's Consort * I always take in,
To solve the Charades I request to begin ;
And should I include all the Rebuses too,
The author will kindly excuse me I know.—
How nicely selected ! There's *Roastbeef* and *Lark*,
With a *Fireside* to cheer us when gloomy and dark ;
But during *Night's shadow*, if you should incline
To bid a *Farewell* to the music and wine ;
Or if at the cards you would spend a few hours,
Mary Palmer and *Anderson* say they are yours.
* The Supplement.

Then on the next morning, but visit the brook;
You'll see the fresh *Snowdrops* just ready to pluck.
These then are the treasures of Dia's fam'd pages,
Which renowned will flourish from ages to ages.

2. *The same; by Miss Betty Boys, of Stainton Vale.*

To *Nawton*, a village not far from the moors,
I went on Shrove-Tuesday, to pass a few hours,
With others, my friends, some young fair ones of note,
And shepherds so sprightly to taste of the sport;
All big with expectation, determin'd to prove
The blessings effusive of music and love.
No sooner so brisk was the dinner-bell rung,
But *Roastbeef*, the pride of Old England, was sung,
That excellent dish; while large portions of ale
Were from *Fireside* brought, our minds to regale:
Delightful and free, so we pass'd the long day,
In feasting, regaling, and innocent play.
At *Night*, when the black *Shade* of darkness came on,
We by the musician were joyous led on
To dance; then we started, each friendly and free,
Each nymph was so charming and lovely to see;
Miss *Anderson*, *Lark*, *Mary Palmer* and I,
In dancing a minuet, every one did outvie;
We footed the tune like the Romans of old,
And drew from the *Snowdrop* the sweet marigold.
When weary with dancing, we each to our home,
Thro' meadows and valleys, did jocundly roam;
Avowing, if living, next feast we should meet,
Each other at Nawton, with compliments sweet.

3. *To Mr. Savage; by Mr. John Brooksbank, of Howden.*

If you, Mr. Savage, in wedlock's soft band,
To fair *Mary Palmer* unite heart and hand;
And if you'll to me and Miss *Anderson* send
A line by the post, we'll the wedding attend.
But be sure you provide a good store of *Roastbeef*,
And plenty of *Larks*, to give hunger relief;
For more of your friends, my good sir, than us two,
Intend that blest day, sure to wait upon you.
Should the weather be cold, we'll sit by the *Fireside*,
There drink a good health to the bridegroom and bride,
The breast of each bridemaid a *Snowdrop* shall grace,
And smiles shall alone decorate every face.
In sweet conversation the day shall be spent,
And at *Night* bid a *Farewell* with joy and content.

4. *The same, by the Rev. Mr. Ewbank, of Thornton-Steward.*

I sat myself down by the *side* of the *Fire*,
    Before the *Roastbeef* was brought in,
When the Supplement came, as I much did desire,
    Ere the *Night* spread the *shades*, to begin
To solve what I could : and I think it appears,
Mary Palmer's the lady John Savage reveres.
Miss *Anderson* sings the departure of eve,
    More sweet than the *Lark* in the morn;
What pleasure in walking with her they receive,
    E'en when *Snowdrops* the borders adorn !
All are solv'd now, but one, which I sure ought to tell ;
If I miss, 'twill be strange, lovely ladies, *Farewell*.

5. *The same, by Mr. John Fildes, Schoolmaster, Liverpool.*

Miss *Anderson* has charms that would
    The coldest heart ensnare ;
And *Mary Palmer* is both good,
    And as a *Snowdrop* fair.

No blushing rose, though newly blown,
    Such sweetness can display ;
No *Farewell* so sincere is known,
    No *Lark* so blithe and gay.

Some men *Roastbeef* delight to eat,
    And love a good *Fireside* ;
But far more blest must be his fate,
    Who gets a blooming bride,

That is of worth like theirs possest ;
    True peace he will enjoy ;
Nor *Nightshade*, which most men detest,
    His happiness annoy.

6. *The same, by Jacobus, of Norwich.*

When the *Nightshades* envelope us round,
    And Sol has forsaken the West ;
When the *Snow drops* in flakes to the ground,
    And the *Lark* hies him home to his nest :

Then to the *Fireside* I repair,
    To partake of the chat of a friend,
Or the pleasures of Dia to share,
    Where wit and good-humour oft blend :

Where many a fair one stands forth,
    Loth to bid a *Farewell* unto fame,
(*Mary Palmer* and *Anderson*, both
    To a sprig of her laurel lay claim.)

B

How ſweet is the converſe of Di,
    When th' ev'nings of Winter appear!
She makes the dull minutes to fly,,
    And baniſhes every care.

7. *To Miſs Mary Palmer, of R——y, by Mr. John*
    Savage, of Norton.

Roaſtbeef, though excellent indeed,
    Can never once with thee compare,
Dear lovely maid, for whom I bleed,
    Sweet charming *Mary Palmer* fair.

Let Tim' his *Anderſon* purſue,
    And her preſent with Sky-*Lark* rare,
The only object in my view,
    Is lovely *Mary Palmer* fair.

When *Night* her *ſhad*ing curtain ſpreads,
    And brighteſt *Snowdrops* diſappear,
I long to rove the fertile meads,
    With charming *Mary Palmer* fair.

Could I *love-letters** well indite,   * or *Farewell.*
    Then by *Fireſide*, ſo warm I there,
In moving ſtrains to thee would write,
    Sweet charming *Mary Palmer* fair.

O could I but prevail on thee,
    Connubial joys with me to ſhare,
Ah then how happy ſhould I be,
    With lovely *Mary Palmer* fair!

8. *The Village Feaſt ; by Mr. Tho. R. Smart, of*
    Burton on the Wolds.

The *Shades* of *Night* ſpread o'er the plain,
    The *Lark* retir'd to reſt ;
The jocund bells in merry ſtrain
    Proclaim the village feaſt.

Near the *Fireſide* the table ſpread,
    Roaſtbeef and humming beer ;
Miſs *Anderſon*, that lovely maid,
    With *Mary Palmer* there.

A *Snowdrop* decks each ſmiling fair,
    The dance, or cards amuſe ;
The married ſwains a glaſs prefer,
    And gravely read the *news**.   * or *Farewell.*

*Various other ingenious anſwers to the Rebuſes and Charades were
given by the following ladies and gentlemen, viz. Adelina, Jas. An-
derſon, Jno. Aſhcroft, I. Bayley, Jno. Browne, Geo. Cook, Wm. Davis,
T. S Evans, Wm. Goſs, T. Hewitt, Wilos Hoſsman, Miſs A, W.
Maken, W. Marriot, Ortonian, Young Painter, Da. Roberts, Alex.
Rowe, R. S, Miſs Eliz. Saul, Miſs A. T, W. Watts, &c.*

Answers *to the* Diary Queries.

Diary Query I, *anſwered by Mr. T. Hewitt, Spital-fields.*

Clouds moving, ſome in one direction and ſome in another, muſt, I think, be owing to the different currents of air from oppoſite points, at different heights, and of different denſities, in order to maintain or keep an equilibrium ; and, as it were, move the clouds the contrary way, while others are ſeen to move the ſame way as the wind blows with us.

The ſame anſwered by Mr. Wm. Marriot, of Neath.

It is manifeſt that the direction of the clouds muſt be the ſame as that of the wind ; becauſe they move from its impulſe. Hence if two different currents of wind (which is ſometimes the caſe,) blow in contrary directions, the clouds of courſe muſt move in thoſe directions. To account philoſophically for ſuch motions of the air, would take up more room than the li-mits of the Diary can admit ; and it is the leſs neceſſary, as every enquirer may eaſily ſatisfy himſelf from the writings of others on the ſubject. I would therefore refer Mr. Burdon to Dr. Hutton's Math. and Philoſ. Dictionary, lately publiſhed.

The ſame, by Mr. Tho. Croſbey, of York.

The great phenomena of nature, the generation of thunder, lightning, ſnow, hail: &c, are objects which neceſſarily excite the wonder, and call forth the curioſity of mankind to enquire into their cauſes. But as meteorology is but yet in its infancy, a preciſe account of theſe phenomena can hardly be expected : however, to give as juſt a ſolution as poſſible to the preſent Query, it will be neceſſary, I apprehend, to have recourſe to the accounts of aërologiſts. A few years ago, Mr. Lunardi aſcended in his balloon from the riding-ſchool ground behind York Cathedral ; and after he had aſcended many hundred yards in a north-eaſt direction, I obſerved with a good glaſs that the balloon had varied its courſe more towards the Eaſt ; which it is evident could not have happened unleſs the wind had changed. This however I found had not been the caſe to the ſpectators on the ſurface of the earth. I therefore concluded that the air at different heights muſt blow different ways. This however was no demonſtration to me, until the gentleman came back again from his aërial voyage, when he fully ſatisfied my enquiries by aſſuring us that it really was the caſe. Mr. Bald-win, who aſcended from Cheſter in Mr. Lunardi's balloon, the 8th of September 1785, farther confirms the ſame. This gen-tleman aſſures us, that he traverſed the atmoſphere in different directions. Hence then we ſee the reaſon of clouds flying dif-ferent ways at the ſame time.

DIARY QUERY 2 answered by Mr. R. Burton, of Salton.

The flame of a candle, and consequently the time of its duration or consumption, depends much on the size of its wick. A thick candle with a small wick, burns with a tall snuff; but a small candle with a thick wick, burns with a short snuff: hence there is a certain size of a snuff adapted to the size of every candle, with which it will burn at a regular rate if not disturbed: but if the size of that snuff be shortened, the flame will be diminished for some time, and consequently the duration will be longer for being frequently snuffed.

Jacobus of Norwich, on the other hand, says,—The candle being frequently snuffed, the heat of the flame will be increased each time, and of consequence consume the candle much faster than if the snuff of it were permitted to remain, since the snuff will cause the flame to burn languid, and so diminish the heat necessary to melt the substance of the candle.

Luciler of Norfolk says,—A candle consumes faster by being snuffed, as a part of the tallow is taken away with the snuff.

Mr. Wm. Marriot says—A candle will certainly consume faster from being frequently snuffed, than not so; and the reason of it seems to be this: the tallow will support a certain quantity of flame, in proportion to the size of the candle and the wick; and when the flame is partly filled up by the wick remaining unsnuffed, it draws with less force, and requires less support; besides, the burning part of the wick helps to make the flame more steady. And yet it appears from the experiments of Sir Ben. Thompson (Philof. Transf. 1794,) concerning the intensities of light, that a candle burning with a long wick and dim light, will actually consume more tallow than when properly snuffed.

The SUPPLEMENT QUERIES ANSWERED.

SUPP. QUERY 1 answered by Mr. R. Burton, of Salton.

It is found by experiment, that animal respiration is a humid steam, or floating moisture, the particles of which are in a state of repulsion, and when condensed and weighed, amounts to about one pound in the space of 24 hours from a human body. If this steam touch upon a body warmer than itself, it is impelled; but if upon a colder body, it is condensed into a kind of cloudy or opaque dew. If the cloud of dew is broke by wiping, it runs down the sides of the vessel which condensed it in a stream of transparent water, carrying along with it all other particles which are then condensing, down the current; hence no more opacity will be seen.

The same, by the Rev. Mr. J. Furnafs.

The humid vapours that issue from the people in the carriage meeting with the glass window, the cold there condenses

them.   But these windows being once heated, they repel the vapours instead of contracting them.   The like happens to a decanter of cold water, viz. some of the moist vapours, which are afloat, being intercepted by the decanter, are immediately condensed; but as soon as the decanter is warmed, these condensed particles, endeavouring to fly off, trickle down the side, in the manner mentioned in the query.

Supp. Query 2 *answered by the Rev. Mr. J. Furnass.*

Day light having commenced about half an hour before the time mentioned in the query, the Sun would be visible to some part of the heavens, and he would be past the East point, opposite to the North West quarter, where the bow appeared. Hence it is evident, that the Sun's rays affected the drops of rain in the cloud, and produced the rain-bow in the usual way.

Supp. Query 3 *answered by Mr. John Brooksbank.*

I am of opinion, that the adage, " True blue will never stain," originates from blue being one of our national colours; and the meaning of it is, that a true-born Englishman will not deviate from his duty, or stain his character by cowardice or treachery.

Supp. Query 4 *answered by Mr. J. Brooksbank.*

In whatever bosom sympathy is found, in the same bosom we are sure to find philanthropy; and as tragedy represents the afflictions and distresses of our fellow-creatures; so the true sympathetic bosom, though oppressed and afflicted with the scenes of affliction and distress, is, by the spirit of philanthropy, always the most solicitous to see them.

The same answered by Mr. John Liddell.

That people who are most affected with seeing a tragedy acted, are the most solicitous to see it performed, is a manifest proof of their sensibility and the fineness of their feelings. Their sympathetic dispositions are never more gratified than with the fight of that which is the most agreeable to their nature:—— Hence we find the truly charitable studiously seeking those afflicted objects which others will endeavour to avoid.

Various ingenious answers to the Queries, both in the Diary and Supplement, were given by the following ladies and gentlemen, viz. Academicus, Artuofo, Jno. Ashcroft, N. Bosworth, Jno. Brooksbank, Ra. Burton, J. Campbell, W. Clark, Geo. Cook, Tho. Coulson, Tho. Crawhall, Tho. Crosbey, Ra. Dixon, Ra. Dutton, J. Ewbank. Jno. Fildes, Wm. Francis, jun. J. Furnass, T. Hewitt, I. Hayton, W. Hoffman, Rd. Humber, Jacobus, Jno. Liddell, Lucyler, Lysander, Wm. Marriot, Nancy Mason, Young Painter, Philagathus, Alex. Rowe, John Savage, J. J. Peat, Betsey R, Jno. Ramsay, Da. Robarts, T. S, Jno. Savage, Silentio, Tho. R. Smart, Sylvanus, A. T, Jno. Walton, Wm. Ward, Rd. Wood, T. I. Wood, &c.

N. B. Some letters came too late to hand, particularly that of Mr. Gruaidge; and some were not received, as not being post-paid.

New Enigmas.

I. Enigma, *by Mr. Tho. Coulſon, of Rookhope.*

Ladies, kind heaven's indulgence cou'd not beſtow
A greater gift on mortals here below;
For you no ſooner graſp ſome frail delight,
But, ready for its everlaſting flight,
Ere you can call the haſty joy your own,
If not reſtrain'd by me, for ever gone.
I to the fond ſuccesful lover's heart,
A thouſand melting raptures do impart;
The flattering image wears a livelier grace,
A ſofter mien, a more enticing face,
When yet more lovely, amiable and kind,
I bring the fancied idea to the mind.
I, from the flying minutes, do retrieve
The joy's Clorinda's wit and humour give;
Whene'er I ſpeak, I all your ſoul inſpire,
Brighten each thought, and give each Muſe new fire;
'Tis I that lend your daring fancy wings,
Soften each lyre, and tune the warbling ſtrings.
I only to the guilty am ſevere,
Who the review of their paſt actions fear;
But to the innocent and virtuous mind
Am ſtill propitious, ſmiling ſtill and kind.
To me you all thoſe charming pleaſures owe,
The pleaſures that from generous actions flow,
And they are ſtill the nobleſt here below.

II. Enigma, *by Mr. David Daniel.*

Think, ladies, what we wretches feel;
   Devoid of ev'ry hope,
We 're doom'd to undergo the wheel,
   The gibbet and the rope.

The common forms of right and wrong
   To us are ſtill deny'd;
For (ſhame to tell!) we firſt are hung,
   And afterwards are try'd.

Our harden'd inmates too, e'en they,
   Supported by our pow'r,
Ungrateful with our torments play,
   And thump us till we roar.

Yet maugre theſe our loud laments,
   Our toſſings to and fro,
We oft are made the inſtruments
   Of joy as well as woe.

Whether furvey'd in Weft or Eaſt,
    Our foreman is the ſmalleſt;
Yet leads and governs he, tho' leaſt,
    The largeſt and the talleſt.

In harmony, tho' not in par.
    Brother agrees with brother,
'Till meddling blockheads make us jar,
    And fall foul on each other.

But ſoft! 'tis time to hold our tongues,
    For long ere this we doubt,
E'en when we firſt proclaim'd our wrongs,
    You muſt have found us out.

III. ENIGMA, *by Mrs. Hallilay.*

As conſtant as I grace the throne,
    Salute the royal pair;
Dukes, lords, and ladies, all muſt own,
    My wonted favours ſhare.

The Eaſtern Monarch's dear command,
    Fond Cupid's ſceptre ſways,
Thus challeng'd from the Sultan's hand,
    My pliant frame obeys.

Should grief aſſail for parent's corſe,
    I dry the orphan's tear,
And changeable, without remorſe,
    Quite odiouſly appear.

And oft amidſt the buſy crowd,
    Ill-fated guilt's decree,
Tranſmography'd from maſters proud,
    To thoſe of low degree.

Then each try'd heart their vaſſal truſt,
    Such faith I'll not abuſe,
Of pride unconſcious,—lick the duſt,
    And wipe your very ſhoes.

When worn by age quite pale and thin,
    Proud men no honours pay;
But piecemeal torn, my griefs begin,
    Perhaps to form this lay.

IV. ENIGMA, *by Mr. Wm. Jones, of Heyford.*

Again, ye fair, the tuneful band I join,
To bring my tribute to Diaria's ſhrine.
O could the Muſe the pleaſing taſk purſue,
In ſtrains more worthy her, more worthy you!
Would Fortunatus but regard my pray'r,
And let me once his cap of wiſhes wear;

In lofty numbers fhould your fame be fhown,
To diftant ages, and to worlds unknown;
But vain the hope—yet lovely nymphs extend
Your wonted candour to the tale I've penn'd.

From climes remote a ftranger now behold,
A much-lov'd fav'rite of the young and old;
Whofe peerlefs merits are by all confeft,
And all receive him as a welcome gueft.
His num'rous titles will his worth declare,
And fhew his eftimation with the fair;
But be his rank and hue whate'er they will,
His favour 's fought for, and his levees fill;
And fpite of envy he fhall ever reign
The favour'd object of each nymph and fwain.
Attendant flaves in gayeft liv'ry wait,
To introduce him to the rich and great;
While thofe of low degree with equal care
For his reception fplendid domes prepare.
Of earthly grandeur this his higheft ftate
Muft quickly feel a fad reverfe of fate.
Ere Phœbus thrice has deck'd the orient fkies,
And bade the morn in all its fplendors rife,
Forth from the turret with impetuous hafte
He's tumbled headlong, and in prifon caft;
Where favage beafts the dungeon's mouth defend,
And moiften'd walls hot exhalations fend;
Tho' art in vain attempts the ills to fcreen,
By fpreading landfkips of a lafting green;
Tho' on the walls the choiceft fruits appear,
Thro' every feafon of the varying year;
Tho' fportive fancy bids creations rife
The purpofe fhines thro' ev'ry faint difguife.
So fmile-clad features and external fhow
Can ne'er fecurely veil internal woe.
In quiet there he muft not long remain,
A direful monfter high above the plain,
With trunk protuberant and vifage red,
His vengeance pours on his devoted head;
While vigour lafts he ftill purfues the blow
With equal heat, and lays the victim low.
The gay affembly, on the fcene intent,
In expectation wait the dread event;
Yet not in pity will an arm extend,
From fuch diftrefs to fave a fuff'ring friend,
Who by his fall contributes oft to raife,
Around the altar wit's effulgent blaze;
While fome fam'd prieftefs with enquiring eyes
Infpects the entrails of the facrifice;

And thence determines with unqueftion'd fkill,
The fix'd decrees of fate's unconquer'd will;
How Coquettilla, love's imbitter'd foe,
In fingle ftate fhall feek the fhades below;
That lov'd Prudentia quickly fhall refign
Her hand and heart at Hymen's hallow'd fhrine;
Of Sylvia's fadnefs fhe declares the caufe,
While Sylvia blufhing from the fane withdraws.—
   The rites are ended;—now, ye fprightly fair,
Make known the hero, and his favours fhare.

V. Enigma, *by Mr. W. Kirkley, Hefledon.*

Long ere the Sun ufurp'd with flaming light,
The cold, dark, wide domain of ancient night,
In heav'n (fo Milton fings) I found a place,
And joyful oft approach'd the throne of grace:
There ftill a fav'rite, and yet, ftrange to tell,
Among the damn'd for ever doom'd to dwell.
To caufes oppofite I owe my birth,
O'er feas now roaming, vagrant now on earth.
The lonely grove, where flighted nymphs complain,
I haunt, or glad the jocund on the plain.
In bufy towns a thoufand modes I wear,
Cameleon like, and live, like him, on air.
When armies meet in terrible array,
I cheer the foldier, and begin the fray;
Mix'd in the combat, thro' the ranks I fly,
Shout with the victor, with the vanquifh'd figh.
With horror oft I ftrike the finking foul,
And oft the tide of ftreaming grief controul.
Found in the hoftile blow, the cordial kifs,
By turns the life and death of focial blifs.
Ladies, to you well-known, I now appeal,
In next year's Diary, my fecret name reveal.

VI. Enigma, *by Mr. Ifaac Saul, Holland near Wigan.*

Where daifeys fmile in yonder meads,
And winds breathe foftly thro' the reeds;
Where warbling larks that mount on high,
Salute with joy the morning fky;
Near yonder copfe, befide the ftream,
Whofe waves reflect the funny beam;
I had my birth, and grew, defign'd
To profit and reform mankind.
The ruftic clown, the learn'd, the brave,
The hero, coward, and the flave;
And ladies too, it has been faid,
Of me have often been afraid.

Some at my fight with horror fhake,
And fome of me no notice take.——
Yet not to fcenes of fear confin'd,
I oft relieve th' afflicted mind ;
To ficknefs, forrow, fpleen, and grief,
My cheering virtues bring relief;
And the induftrious country dame
Knows well my worth, my ufe and name.——
In durance vile I've often been ;
Where learning is as often feen ;
I learning aid, but I muft own,
I have myfelf no learning known.——
In public ftreets and ways I'm found,
Where clouds of duft I fpread around,
In dirty work I'm much employ'd,
Until my being is deftroy'd.——
With labour when worn out at laft,
And all my fervices are paft,
I'm doom'd by fate to end my days,
Like Phœnix, in a fiery blaze.

VII. ENIGMA, *by Mr. T. R. Smart, Burton on the Wolds.*

When firft Jehovah fram'd this earth,
  To form the atoms ran ;
Without his aid, I boaft my birth,
  And own for maker man.

On defert plains I often live,
  Or in the darkeft gloom ;
And men of greateft wit believe
  I haunt the filent tomb.

More polifh'd than Eliza's mind,
  More beauteous than her face ;
Surer than death you me may find,
  Swifter than light my pace.

Yet, true I am (I'll not difguife)
  Worfe than the greateft evil ;
The fwains oft fee me with furprife,
  And fwear they 've feen the devil.

I'm more than fwine to dirt inclin'd,
  Nay, filthier than a jakes ;
Yet many a wight on me has din'd,
  Inftead of ale and fteaks.

Armies for me have often fought,
  Oft drawn the bloody rapier ;
For me philofophers have wrote,
  And fully'd reams of paper.

　　Nor think at truth's expence I shine,
　　　Or call the notion odd;
　　For I excell ev'n power divine,
　　　And greater than a God.

VIII. *or* Prize Enigma, *by Mr. T. Woolston, Adderbury.*

[*Whoever answers it before Feb. 2, has a chance, by lot, for Ten Supplements.*]

Attend ye lovely fair, whom genius leads
To Dia's mystic fane, while I display
The causes of my birth and wondrous pow'rs,
Which in her pages yet remain unsung.
—Much I adorn you; yes, it well becomes
Your early care to cultivate my charms;
But O beware, nor let me e'er betray
A canker'd heart, nor shew malignant scorn
The hateful inmate of your tender breast.
　　First seen with Adam, in the happy groves
Of flowery Eden, when fair Eve he found,
His lovely inmate, mother of mankind.
She wond'ring stood, in all her virgin charms,
Modest tho' unabash'd, while I uncall'd
Attended to improve her native grace,
And gave her mystic charms a tenfold pow'r.
How great that power, let sighing lovers tell!
　　Quite sick with fev'rish fears from day to day,
Young Edwin languish'd, torn with anxious doubts,
That almost banish'd hope, till fortune kind,
Brought gentle Emma to the lovely grove,
Where long he hid his griefs, and sigh'd forlorn.
A few faint words he utter'd, while his looks
Pleaded more forcibly than tongue could speak,
And told a tale sincere of artless love.
The flatt'ring thought, to find herself beheld
An object worthy such extreme regard,
Excited pleasure in her throbbing breast,
Mix'd with kind pity for young Edwin's pain.
Awhile she silent stood, then softly turn'd,
And kindly gave me to the love-lorn youth,
A precious balm, to soothe his mind to peace.
That instant trembling transport shook his nerves,
His eyes beam'd joy, though all suffus'd with tears,
As over lovely Emma still they rov'd,
And found new beauties rise at every view.
—Yes, then my charms outweigh'd the richest gems!
Was more to Edwin's heart than crowns could give,
And cancell'd in an instant all his pain!——

In courts I'm ever found, but there I mask
The vile intrigues, and shameless sly deceit,
Of vet'ran courtiers. Ah how many build
Their dearest hopes upon my slipp'ry base !
An evanescent phantom soon dissolv'd,
I vanish into nothing quite forgotten.
Trust me not there—Nor you, ye giddy youths
Whom Pleasure leads in flow'ry fetters bound,
To drown your wits in her Circean bowls ;
O never trust me, where in haunts impure
I mimic artless innocence and love ;
An ignis fatuus there, I oft allure
To pain, to shame, and everlasting woe.
　　Tho' only giv'n by heav'n to human kind,
The child of reason born of happy minds,
Yet am I oft produced by the brute ;
The clumsy, awkward, antic, shaggy bear,
The frisking kitten, or the sportive lamb.
And when gay spring all nature's charms unfolds,
The hills, the vales, and vocal shady woods,
Are said in prospect all my charms to wear.
Ladies, adieu, and may my winning grace
Ever improve and dignify your charms.

New REBUSES, CHARADES, and QUERIES.

I. REBUS, by Mr. Philip Norris, Liverpool.
He who from Colchis stole the golden fleece,
And he who sought in Hell his Eurydice,
The Greek whose life Apollo did prolong,
That giant, nam'd most powerful and strong,
And he whose voice as loud as fifty's rung ;
Will name a bard, in Di, well known to fame,
Whose muse has gain'd him an immortal name.

II. REBUS, by Mr. R—— * S——.
Those whom I'll ne'er envy, tho' nothing they need ;
The tool of a draper, depriv'd of its head ;
The head of a friend who oft dazzles our eyes ;
And lastly, when headless, an author likewise,
Whose works mathematic declare him to stand
The foremost of science's sons in this land ;
These duly connected will straightway explore
His * name, who ne'er wrote in the Diary before.

III. REBUS, by Miss Betty Boys, Stainton Vale.
Take one-fourth what the milkmaid does daily carets,
　　Ye sons of bright science and fame,
And join 't to three-fifths of what records express,
　　An Offspring, or such like in name.

Behold then the prefent that Damon to Kate
   Did give when beneath the green oak;
Tho' pleafant, delightful, becoming in ftate,
   Her blufhes refum'd it a joke.

IV. REBUS, *by Mr. Newton Bofworth, of Peterborough.*
A country where diftraction reigns;
What's feen in Winter on the plains;
The glory of Britannia's ifle,
Whofe aid would make the captive fmile;
A king in fcripture often nam'd;
The fields for joy and gladnefs fam'd;
A perfon for great ftrength renown'd,
Whofe name in facred writ is found.
Th' initials found, and join'd aright,
A fongfter's name will bring to light,
Who often does to Diary write.   }

I. CHARADE, *by Adelina.*

My firft gives fhelter to the bounding deer,
Or hides the timid hare when danger's near;
Soon as Aurora tips the clouds with red,
My next is heard from yonder ftraw-rooft fhed;
When fnows defcend, and Winter holds his fway,
My third to this bleft ifland wings his way.

II. CHARADE, *by Aurora.*

Unworthy men, who gain my firft,
   To trifle with their blifs;
Ah, lucklefs maid, to lofe my next,
   In fuch a caufe as this!

My whole, a modeft fimple flow'r,
   Had fcarce been known to blow,
But Shakefpeare gave it fov'reign pow'r,
   And taught its juice to flow.

III. CHARADE, *by Mr. Tho. Crofbey, of York.*

Arife my mufe, on fancy's wing arife,
And foar aloft, and fcale the concave fkies,
To nature's utmoft bounds direct thy daring flight,
Through fields of ether, deluges of light;
Then from the regions of the boundlefs fky,
Where born in clouds aërial fpirits fly,
Where kings and heroes fill the folemn fcene,
Whofe laurels boaft a bright celeftial green;
From thefe unbounded ambient realms of day,
Next dart to earth, and tell the fecrets there:
But hufh my mufe! my charming firft I hear,
Carrolling his fongs aloft in open air;

Hark! how he ushers in the fragrant morn
With songs harmonious o'er yon standing corn.
Not so my second—for as Hodge he rides,
It galls his mare, and rankles in her sides.
My whole, dear gents, is worthy of the fair,
Who look so lovely, and so debonair.

IV. CHARADE, by Mr. Jas. Davison, Newcastle.

In hopes, my First, by thee to gain,
What millions plow the stormy main!
Impetuous Second! stir not up
Thy rage to blast the merchant's hope:
Hush'd be the storm, serene the skies;
Arise, propitious Whole! arise,

I. QUERY, by Mr. Rd. Ashcroft, of Eccles.

In our navigable canals, when a scarcity of water happens, as in the Summer or droughty weather, it is observed, that the boats or barges do not proceed with their usual ease or velocity, though the same power be acting to draw them forward. Now, one would imagine, when the boat swims clear of the bottom, it could cause no difference in other respects. Quere therefore what reason can be assigned for it?

II. QUERY, by Mr. Ralph Dutton.

I shall thank the ladies to inform me of the reason, why they first pour a little boiling water on their tea, and some time afterwards fill up the pot; in preference to filling up the pot at once?

III. QUERY, by the Rev. Mr. J. Ewbank, of Thornton-Steward.

If one looks at the sun, or snow, &c, for any considerable time, one sees a faint image of them afterwards, which for a time dims the sight when the eye is directed to another object. Quere the reason?

IV. QUERY, by Malvolio.

Required the reason, that people advancing in years become grey-haired; and why some are so sooner than others?

Of the SOLAR and LUNAR ECLIPSES, &c, this Year.

There will happen this year four Eclipses of the two great luminaries, viz. three of the Sun, and one of the Moon; but none of them will be visible to the inhabitants of these isles.—They happen in the following order.

I. The first is an Eclipse of the Sun, which happens on Sunday the 10th of January, at 5 minutes past our six in the

morning, confequently invifible, both to us, and to all the other Northern nations of the globe; but in the Southern regions it will be a very great Eclipfe, and in fome parts central and annular, the breadth of the annulus being about half a digit on all fides; a very beautiful appearance for the inhabitants to behold that lie in the track of the central fhadow. The Eclipfe will be vifible along the great Southern Ocean, from the Ifland of Madagafcar to that of New Holland.

II. The fecond is another Eclipfe of the great luminary the Sun, which happens on Monday, the 4th of July, at one minute paft our 11 o'clock at night; when this Eclipfe is both central and total on the meridian, about 40 degrees of longitude Weft of the North-wefternmoft point of California, on the Weft fide of North America. Confequently this will be a vifible and large Eclipfe along the North parts of the great Pacific Ocean, by the Iflands of Japan, the Philipines, the Ladrones, and Sandwich Ifles, &c; to feveral parts of which the Sun will be totally eclipfed.

III. The third is a partial Eclipfe of the Moon, which happens on Wednefday, the 14th of December, and the times and quantity of it are as follow:

       The beginning is at   1h. 9m. afternoon,
       The middle   -   2 21
       The end of the Eclipfe, 3 34
       Digits eclipfed 6° 1' on the Moon's North Limb.

As the Eclipfe is over confiderably before the Sun fets, and confequently before the Moon rifes, the Eclipfe is therefore not vifible to us, nor to moft parts of our hemifphere; but the Moon rifes eclipfed at the Orkney Iflands, on the North of Scotland. At the middle of the Eclipfe, the Moon will be vertical to a point a little to the North of the Ladrone Iflands, viz. in latitude $22\frac{1}{2}$ degrees North, and almoft 145 degrees Eaft longitude from London. Confequently this Eclipfe will be vifible to the whole Continent of Afia, and to moft parts of the great Pacific Ocean; at the ifles Sunda, Borneo, the Philipines, Japan, the Sandwich, the Friendly, and the Society Ifles, the New Hebrides, New Zealand, Van Diemen's Land, New Holland, &c. The beginning will be vifible as far as the Weftern Coaft of the American Continent, and the end will extend itfelf as far as Poland, Sweden, Denmark, Norway, Germany, and Holland.

IV. The fourth, and laft, is another invifible Eclipfe of the Sun, which happens on Thurfday, the 29th of December, at our 6 o'clock in the morning, before Sun-rife. This will be a very great Eclipfe, not total indeed, but annular, and
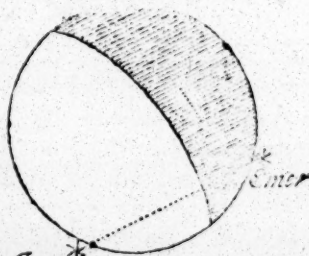
the breadth of the annulus, in the central path, will be about half a digit on all sides. This appearance happens on the meridian, or exactly at noon, in 65½ degrees of South latitude, and 91½ degrees of East longitude, that is, nearly 2000 miles South from Van Diemen's land. The Eclipse is therefore chiefly visible to the great South Sea, and especially the more Southern parts of it, including New Holland, and the other islands in those seas.

Other Remarkable Phenomena.

The following remarkable conjunctions of the Planets will take place this year, as seen from the earth.

1. Between the beautiful planets Jupiter and Venus there will be a conjunction, on the 11th of January, when Venus will be seen only 54 minutes North of Jupiter, that being the difference of their latitude ; and they will be seen to shine in the West a little after Sun-set.

2. A remarkable occultation of the planet Saturn, by the Moon. This will happen on Friday, the 21st of October, and will be visible here, if the weather be clear. The beginning, or immersion of Saturn behind the bright part of the Moon, will be near the bottom, on the left-hand side, at 28 minutes past 1 that morning; and the end, or emersion, will be from behind her dark part, a little higher up on the right-hand side, at 14 minutes after 2, as appears in the annexed figure, where the shaded part of the figure represents the unilluminated part of the Moon at that time, and the dotted line shews the path of Saturn.— Through a telescope his occultation will afford a curious appearance, as Saturn's ring will at this time appear to encompass his body, and extend itself to a considerable distance on each side of the planet.

3. A conjunction of the planets Jupiter and Mars. This will happen on Friday the 16th of December, when Mars will be only 14 minutes to the North or above Jupiter. They will appear in the West after Sun-set, and may be seen to set nearly together about 10 o'clock that night.

Answers *to the* Mathematical Questions *propoſed in the laſt* Supplement.

I. Supp. Question (45) *anſwered by Maſter Geo. May, Pupil at Mr. Gregory's Boarding School, Yaxley, Hunts.*

In Dr. Hutton's Math. and Philoſ. Dictionary, under the article Circle, the firſt property mentioned, is, that "The circle is the moſt capacious of all plane figures, or contains the greateſt area within the ſame perimeter, or has the leaſt perimeter about the ſame area." Therefore the queſtion is the ſame as to find the circumference of a circle whoſe area is 4840 yards, being the number in one acre; conſequently, by the rule for the area from the circumference, we have $\sqrt{\dfrac{4840}{\cdot 079577}} = 246\cdot62$ yards, for the circumference, or length of the line required.

The ſame anſwered by Mr. James Mulcaſter, Langly Mill.

Of all figures, a circle is the moſt comprehenſive, with regard to its circumference; therefore we have the area of a circle given, to find its circumference; which may be directly done by inverting the 5th rule, pa. 111 of Hutton's Compendious Meaſurer, viz. as $7 : 88 :: 1$ acre or 4840 yards, to $60845\cdot71416$ the ſquare of the periphery, whoſe ſquare root gives $246\cdot65$ for the ſhorteſt line required.

The ſame anſwered by Mr. W. Virgo, of Thornbury.

It is well known that the ſhorteſt line which will encloſe a given area, is a circle. Let the ſaid line be $= x$; then (by rule 3, pa. 111 of the Meaſurer) $\cdot07958 x^2 = 1$ acre $= 160$ poles; therefore $x = \sqrt{160 \div \cdot07958} = 44\cdot839$ poles, the length required.

This queſtion was alſo anſwered by Meſſieurs Ja. Alderſon, Rd. Aſhcroft, Wm. Atkinſon, Newton Boſworth, Wm. Burdon, Ra. Burton, Colin Campbell, Tho. Coultherd, John Craggs, Wm. Davies, Rob. Dowden, Rd. Elliott, Rd. Embledon, T. S. Evans, J. Ewbank, Joſ. Fitzwalter, Wm. Francis, jun. Jno. Fennell, J. Furnaſs, Joſ. Gittins, Wm. Goſs, John Graham, John Hawkes, T. Hewitt, Tho. Hornby, John Hutherſal, Wm. Marriot, Nancy Maſon, Rd. Oliver, Tho. Ridout, Da. Robarts, Wm. Robinſon, John Roſs, R. S, Iſaac Saul, John Surtees, A. Thompſon, Henry Wade, W. Watts, and Rd. Wood.

II. Supp. Question (46) *anſwered by Mr. Wm. Marriot, of Neath.*

Firſt, a million of millions is 1000000000000, which divided by 100 gives 10000000000 minutes; this again by 60 gives $166666666\frac{2}{3}$ hours, and this divided by 6 gives $27777777\cdot777$ days. Now, if 4 years be taken at 1461 days, then $\dfrac{27777777\cdot777}{1461}$

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$= 19012 \cdot 8527$, which multiplied by 4 gives $76051 \cdot 4108$ years, the time required.

The same answered by Mr. Wm. Davies, of Gluvias.

First $100 \times 60 \times 6 = 36000$ is the number counted in one day; then $1000000000000 \div 36000 = 27777777 \cdot 77$ days $= 76051 \cdot 41$ years, allowing 365 days 6 hours to each year.

The same answered by Mr. John Ashcroft.

First, $6 \times 60 \times 100 = 36000$ guineas counted each day.

Then as $36000 : 1$ day $:: 1000000000000 : 27777777 \cdot 7777$ days.

This divided by $365 \cdot 25$, gives $76051 \cdot 41075$ years, or 76051 years 4 months 3 weeks 5 days and 17 minutes, nearly.

Answers to the same question were also given by Messrs. J. Alderson, Rd. Ashcroft, Wm. Atkinson, Newton Bosworth, Wm. Burdon, Ra. Burton, Colin Campbell, Tho. Coulson, Tho. Coultherd, John Craggs, Rob. Dowden, Rd. Elliott, Rd. Embleton, J. Ewbank, John Fennell, Wm. Francis, J. Furnass, J. Gittins, Wm. Goss, John Graham, John Hawkes, John Haycock, T. Hewitt, Tho. Hornby, Wilos Hoftman, John Hutherfal, N. Mason, Geo. May, Ja. Mulcaster, Rd. Oliver, Da. Robarts, Wm. Robinson, John Ramsay, John Ross, R S, If. Saul, John Surtees, James Turnbull, W. Virgo, Henry Wade, W. Walls, and Rd. Wood.

III. Supp. Question (47) answered by Mr. Colin Campbell, Kendal.

As the dealer must have at least one trump, the question is to find the probability of his taking the other 12 out of the remaining 51 cards. Now if $n = 51$, twelve terms of the series

$$\frac{n}{1} \times \frac{n-1}{2} \times \frac{n-2}{3} \ \&c = 158753389900$$

are all the possible combinations of 12 with 51; in which it can only once happen that all the trumps, here used, come together. Hence it appears, that the odds against the dealer holding the 13 trumps in his own hand are as 158753389899 to 1.

The same answered by the Rev. Mr. J. Ewbank, of Thornton-Steward.

Of one trump the dealer is certain. And, by the laws of chance, the probability that he holds the rest is

$$\frac{12}{51} \times \frac{11}{50} \times \frac{10}{49} \times \frac{9}{15} \times \frac{8}{47} \times \frac{7}{46} \times \frac{2}{15} \times \frac{5}{44} \times \frac{4}{43} \times \frac{1}{14} \times \frac{2}{41}$$

$$\times \frac{1}{40} = \frac{1}{158753389900}.$$ This taken from unity leaves

$\frac{158753389899}{158753389900}$ = the probability that he does not hold all the trumps; and consequently the odds against him are as 158753389899 to 1.

Other answers to this question were given by Messrs. Ja. Alderson, Ra. Burton, John Craggs, John Fennell, T. Hewitt, Tho. Hornby, John Hutherfal, Nancy Mason, James Mulcaster, Wm. Robinson, Isaac Saul, John Surtees, W. Virgo, and Henry Wade.

IV. SUPP. QUESTION (48) *answered by Master Geo. May.*

It is well known that each of the surds in the question may be expressed in a more simple form, "by multiplying both numerator and denominator by that surd which multiplied into the denominator gives a rational product." Therefore

$$\sqrt{\frac{6+2\sqrt5}{10-2\sqrt5}} \times \sqrt{\frac{10+2\sqrt5}{10+2\sqrt5}} = \sqrt{\frac{80+32\sqrt5}{80}} = \sqrt{1+\tfrac{2}{5}\sqrt5}.$$

And

$$\sqrt{\frac{2+\sqrt2}{2-\sqrt2}} = \sqrt{\frac{2+\sqrt2}{2-\sqrt2}} \times \sqrt{\frac{2+\sqrt2}{2+\sqrt2}} = \sqrt{\frac{\overline{2+\sqrt2}\,|^2}{2}} =$$

$$\sqrt{\overline{1+\sqrt2}\,)^2} = 1 + \sqrt2.$$

And here note, that the quantity to multiply both numerator and denominator, so as to make the denominator rational, is the same binomial as the denominator, with the sign of one of the terms changed.

The same answered by Mr. W. Burdon, Acaster Malbis.

The expressions in this question may be proved thus:

Because $6 + 2\sqrt5$ is $= 10 + 2\sqrt5 - 4$, therefore

$$10-2\sqrt5)\ 10 + 2\sqrt5 - 4\ (1 + \tfrac{2}{5}\sqrt5\ \text{the first expression.}$$
$$\underline{10 - 2\sqrt5}$$
$$4\sqrt5 - 4$$
$$\underline{4\sqrt5 - 4}$$

Again, $2 + \sqrt2$ is $= 6 + \sqrt2 - 4$, therefore

$$2-\sqrt2)\ 6 + \sqrt2 - 4\ (3 + 2\sqrt2 = 1 + 2\sqrt2 + 2\ (1 + \sqrt2$$
$$\underline{6 - 3\sqrt2}\qquad\qquad\qquad 1$$
$$4\sqrt2 - 4\quad 2 + \sqrt2\quad)\ 2\sqrt2 + 2$$
$$\underline{4\sqrt2 - 4}\qquad\qquad\qquad \underline{2\sqrt2 + 2}$$

Or by the rules given at p. 206, Dr. Hutton's Dictionary, vol. 1, the square root of $3 + 2\sqrt2$ is found to be $1 + \sqrt2$.

Ingenious answers to this question were also given by Messieurs Colin Campbell, Tho. Coulthard, John Craggs, W. Davies, Rob. Dowden, Rd. Elliott, Rd. Embleton, L. Evans, J. Ewbank, Wm. Francis, Jos. Gittins, J. Hartley, John Haycock, T. Hewitt, John Hutherfal, Nancy Mason, Jas. Mulcaster, Da. Robarts, Wm. Robinson, John Ross, A. Roxilli, Isaac Saul, John Surtees, A. Thompson, W. Virgo, and Rd. Wood.

V. SUPP. QUESTION (49) *answered by Mr. Wm. Burdon, Acaster Malbis.*

Let the radii of the three circles be represented by a, b, and c; and put $m = \sqrt{ab + ac + bc} = 6$ chains. Then, by pa. 78

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Hutton's Diarian Miscellany, vol. 3, the three sides of the triangle will be represented by $a \times \dfrac{b+c}{m}$, $b \times \dfrac{a+c}{m}$, and $c \times$

$\dfrac{a+b}{m}$, and the radius of the inscribed circle $= \dfrac{abc}{mm}$. Hence the three sides are 3, 4, and 5 chains, and the radius of the inscribed circle $= 1$. Consequently the area of the pond $= 6$ square chains $= 2$ roods 16 perches.

This problem is elegantly constructed at pa. 76 of the above.

And in the same way is the solution given by Mr. Wm. Marriot; and also by Mr. Colin Campbell, from Landen's Math. Lucubrations, pa. 22.

The same answered by Mr. Wm. Atkinson, of Skipton.

It is proved in Dr. Hutton's edition of the Ladies' Diary, pa. 76, vol. 3, that $EG = FM$, &c. &c. concerning a question similar to this. Now put $AG = 2$ $= a$, $BH = 3 = b$, $CP = 6 = c$, and $EH = x$. Then by the similarity of the triangles EBH and AEG, we have $EH : BH :: AG :$

GE, or $x : b :: a : \dfrac{ab}{x} = EG$; and

(by sim. fig.) $AG : GE :: CP : PE$,

or $a : \dfrac{ab}{x} :: c : \dfrac{bc}{x} = EP$; also BH

$: FH :: CP : PF$, or $b : \dfrac{ab}{x} :: c : \dfrac{ac}{x}$

$= PF$. Therefore $\dfrac{ab}{x} + \dfrac{bc}{x} + \dfrac{ac}{x} = EP + PF + FH = EH$

$= x$; consequently $x = \sqrt{ab + bc + ac} = 6$. Hence the side $EF = EH - FH = EH - EG = 5$; and the side $DE =$ $EI + ID = EG + PF = \dfrac{ab}{x} + \dfrac{ac}{x} = 3$; also the side $DF =$

$DM + MF = EP + EG = \dfrac{bc}{x} + \dfrac{ab}{x} = 4$. Therefore the triangle is right angled, and the area is 6 square chains.

Nearly in the same manner were the answers given by Messieurs Ra. Burton, Colin Campbell, Tho. Coultherd, John Craggs, Wm. Davies, Rd. Elliott, J. Furnass, J. Hartley, John Hawkes, Tho. Hornby, John Hutherfal, Wm. Marriot, James Mulcaster, W. Pearson, Tho. Ridout, Wm. Robinson, Isaac Saul, John Surtees, and W. Watts.

VI. Supp. Question (50) answered by Mr. Wm. Marriot, Neath.

Since the whole weight of the beam is 15lbs, and the length
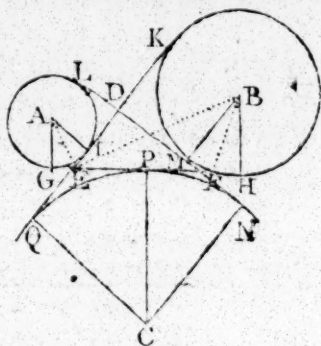
40 inches, the absolute weight of one inch of its length will be $\frac{15 \times 16}{40} = 6$ ounces; and as the lengths of the two arms from the fulcrum are 2 and 38 inches, the relative weight of each arm, referred to the fulcrum, will be half its length multiplied by its absolute weight: hence $6 \times 2 \times 1 = 12$ ounces is the relative weight of the shorter arm of the beam, and $90 \times 2 = 180$lbs is the force with which the constant weight acts at that end; which added to 12 ounces, makes $180\frac{3}{4}$lbs for the whole force acting on that end. Likewise, $38 \times 19 \times 6 = 4332$ oz. $= 270\frac{3}{4}$lb is the force with which the longest end of the beam acts, of itself, without any weights being applied to it: consequently this end preponderates, which seems to imply an error in proposing the question.

But if the constant weight were 180lb, instead of 90lb, then $150 \times 2 = 300$lb, which added to 12 oz. makes $300\frac{3}{4}$lb, the whole force of the shorter end; from which subtracting that of the longer $270\frac{3}{4}$, as found above, leaves 30lb, which in this case is to be balanced by each of the additional weights 1, 2, 3, 4, 5, &c, placed at the several distances from the fulcrum; therefore these distances will be found by dividing the 30lb successively by the 1, 2, 3, 4, 5, &c, which give the quotients 30, 15, 10, $7\frac{1}{2}$, 6, &c, for the several distances sought.

Mr. Wm. Burdon, after his solution, adds as follows:

If the constant weight be 95lb, the distance 2 inches, the weight of the beam 10lb, and its whole length 36 inches, as in Quest. 20, pa. 154, Dr. Hutton's Conic Sections and Select Exercises, the distances to balance the weights 1, 2, 3, 4, &c, will be 30, 15, 10, $7\frac{1}{2}$, 6, 5, $4\frac{2}{7}$, $3\frac{3}{4}$, $3\frac{1}{3}$, 3, $2\frac{8}{11}$, $2\frac{1}{2}$, &c.

Other answers to this question were given by Messieurs Campbell, Craggs, Davies, Elliott, Gittins, Haycock, Hornby, Hutherfal, Mulcaster, Pearson, Ridout, Robinson, Saul, and Surtees.

VII. Supp. Question (51) answered by Mr. Wm. Pearson, North Shields.

Let P be the pole, HO the horizon, Z the zenith, ZA the given azimuth circle, bc the parallel of declination, S the place of the sun at first, and s his place 4 hours after. Then in the isosceles triangle SPs, are given SP = $sP = 66° 32'$, the comp. of declination, and the angle S$Ps = 60°$ or 4 hours; hence is found the perpendicular P$a = 63° 22' 35''$.

Secondly, in the right-angled triangle aPZ, are given aP = $63° 22' 35''$, and the angle aZP = $70°$; hence are found ZP = $72° 3' 11''$, the complement of the latitude $17° 56' 49''$, and the angle aPZ = $49° 44' 56''$. Then $\angle a$PZ $- \angle a$P$s = \angle s$PZ = $19°$
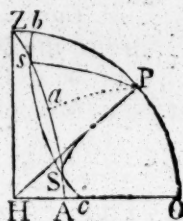
44′ 56″; and the time 10h. 41m. of. 16th. Hence the watch is behind the apparent time by 41 min. 16 thirds.

The same answered by Mr. J. Davies, of Birmingham.

Let ZHO represent a quarter of the sphere; PO any latitude within the tropics Za A the azimuth circle, making the angle AZO = 70°; $bsSc$ the parallel of greatest declination, as the observation was made the 21st of June; S the sun's place at the first observation, and s the same at the second, the difference of time between them being 4 hours, which gives the angle SPs at the pole = 60°; which being bisected by the perpendicular Pa, gives two equal right-angled triangles Pas and PaS, in which there are given PS or Ps = 66° 32′, the codeclination, and the angle aPS or aPs = 30°, to find aP = 63° 22′; also given aP = 63° 22′, and the angle aZP = 70°, to find PZ the colatitude; then aPZ + aPS = ZPS = 79° 42′ the angle at the pole at the first observation; this taken from ZPH = 90°, leaves SPH = 10° 18′, which turned into time, gives 41 min. 11 fec, past 6, the correct time of the first observation, the watch being 4 min. 11 fec. too flow for apparent time. Also ZO — ZP = PO = 17° 57′, the true latitude fought.

Ingenious answers to this question were also given by Messrs Campbell, Coultherd, Craggs, Elliott, Fennell, Hawkes, Haycock, Liddell, Ridout, Robinson, R. S, Surtees, Edw. Warren, and Watts.

VIII. or PRIZE SUPP. QUESTION answered.

To this question various answers have been given, upon different principles, according to the different authors that have written upon the science of Hydrostatics. We may therefore take here a solution or two of each kind, as illustrations of those principles; observing that the differences hence arising are to be attributed to the authors of those principles, and not to the gentlemen who have answered this question.

The answer by Mr. Geo. Baron, of South Shields.

Let AB = 5 feet represent the depth of the water; ABC the perpendicular section of a bank of light earth that will just support the pressure of the water. Then it is evident that AB must be to BC, as 1984, the density of light earth, is to 1000 the density of water; hence

$$BC = \frac{1000 \times 5}{1984} = 2.52016.$$ Also, by Emerson's Fluxions, pa. 141, the curve AC is a femicubical parabola, whose vertex is A, convex towards B; and by pa. 445 Dr. Hutton's Mensuration, the area of

ABC is ⅖ of its circumscribing parallelogram = $\frac{2.52016 \times 5 \times 2}{}$

$= 5\cdot64032$; which multiplied by the length of the bank $= 300$, gives $1512\cdot096$ for the folidity of the whole bank, or number of cubic feet as required. Then, by proportion, as 2240 ($= 1$ ton) $: 124$ ($=$ weight of a cubic foot of light earth) $:: 1512\cdot096 : 83\cdot7053$ tons, which, at 1 fhilling per ton, comes to 4l 3s 8¼d, the expence of the carriage required.

The fame, by Mr. Colin Campbell, of Kendal.

Mr. Emerfon has fhewn, in his Fluxions, pa. 141, that " If ABC be the fection of a wall fupporting a fluid behind it, and joining to the perpendicular fide AB; the curve AC terminating the other fide of the wall, fo that its ftrength may be every where as the preffure it fuftains, is a femicubical parabola whofe vertex is A, and convex towards AC;" which determines the bank of earth to be of the fame form. Let $x = BC$; then will the area of ABC be $= \frac{2}{3} AB \times BC = 2x$, and $2x \times 300 = 600x =$ the content of the bank. Alfo let $y =$ any variable depth of the water; then the fluent of $300y\dot{y} = 3750$ (taking $y = 5$) is as the whole preffure againft the bank. Now when it is made juft to be capable of fupporting this preffure, the fpecific gravities of water and light earth being 1000 and 1984, we evidently have $1\cdot984 \times 600x = 3750$; and hence $x = 3\cdot1502$. Therefore the required quantity of earth or $600x = 1890\cdot12$ cubic feet; the weight of which $= 104\cdot631$ tons, and confequently the carriage of it comes to 5l 4s 7½d.

The fame, by Mr. Wm. Marriot, of Neath.

Let BCDE be a fection of the canal; ABE a fection of the bank: it is proved by the writers on Hydroftatics, that the preffure of the water on the bottom of the canal ED is the fame, whether we take the triangular fection B D E, or the whole fquare one BCDE; and that this preffure on the bottom is equal to the whole preffure on the fide BE, which preffure is as the height of the fluid. Therefore the quantity of earth required to produce an equilibrium, will be reciprocally as its gravity to that of water. Now the fpecific gravities of water and light earth, by Dr. Hutton's Comp. Meafurer, is 1000 to 1984 oz. to the cubic foot. Therefore the quantity of water in the triangular fection BDE (by taking $DE = BE = 5$ feet, as per queftion) will be $5 \times 2\frac{1}{2} = 12\frac{1}{2}$ cubic feet, the weight of which is $1000 \times 12\frac{1}{2} = 12500$ ounces. Hence $\frac{12500}{1984} = 6\cdot3004 =$ the area of the fection ABE of the bank of earth, the perpendicular height of which being 5 feet, we have $\frac{6\cdot3004}{2\cdot5} = 2\cdot52 = AE$
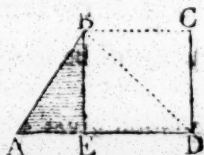
the bafe of the bank, which muft neceffarily terminate in an angle at top, as the preffure of the water there is nothing; hence $6\cdot3004 \times 300 = 1890\cdot12$ cubic feet, the whole content of the bank, and $\dfrac{1890\cdot12 \times 1984}{16} = 234374\cdot88$lb. $= 104\cdot631$ tons, which, at 1 fhilling the ton, comes to 5l 4s 7·572d.

And according to one or other of thefe methods the folution was given by Meffieurs Ra. Burton, John Craggs, Wm. Davies, Rd. Elliott, John Fennell, J. Furnafs, O. G. Gregory, John Haycock, Thomas Hornby, John Hutherfal, John Liddell, Wm. Pearfon, P. Robinfon, Wm. Robinfon, Ifaac Saul, W. Virgo, and W. Watts.

Answers to Diary Questions.

I. Diary Question *anfwered by Mr. Tho. Pengilly, of Guennap.*

Put $x + 1 = m$, and $x + y = n$; then by adding the firft and fecond given equations together, we have $mn = 396$, and from the 3d equation $m + n = 40$. From the fquare of the latter of thefe take 4 times the former, leaves $m^2 - 2mn + n^2 = 16$, the root of which is $m - n = 4$. Hence, and from $m + n = 40$, we have $m = 22$, and $m = 18$. Then thefe give $x = 21$, $y = 11$, and $z = 7$.

The fame anfwered by Mr. Matthew Terry, Settle, Yorkfh.

Divide the fum of the 1ft and 2d equations by $x + 1$, and there will be had $z + y = \dfrac{396}{x + 1}$; this fubftituted in the laft equation gives $x + \dfrac{396}{x + 1} = 39$; from whence $x = 21$. This value being written for x in the 1ft and 2d equations, and y expunged, z is had $= 7$, and therefore $y = 11$. So that the propofer's age on the 1ft of January 1795, was 21 yrs. 11 mo. 7 days, being born January 24, 1773.

II. Diary Question *anfwered by Mr. J. Hartley, Fleet-ftreet.*

The balance of intereft will be the leaft, when the two are on an equality. If $p =$ the fum borrowed and lent again, $x =$ time, $r =$ intereft of 1 pound for a year $= \cdot1$, $R = 1\cdot05$ the ratio, $a =$ the amount of the whole principal and intereft; then will $prx + p = a$ on fimple intereft, and $pR^x = a$ at compound intereft. Therefore $prx + p = pR^x$, or $R^x - rx = 1$; which gives $x = 26\cdot19$ years.

V. Diary Question *answered by Mr. Colin Campbell, Kendal.*

First, from the data, we have two sides and the included angle of a spherical triangle given, to find the third side, viz. the colat. $= 37° 54'$, the codeclin. $= 82° 19'$, and, correcting the time, the angle at the pole $= 100°$, to find the true distance of the sun's centre from the zenith $= 90° 0' 44''$, this *minus* the sun's semidiameter and refraction, *plus* the parallax, is $89° 14' 35''$, the angle of incidence of the light falling upon the water at the upper edge of the vessel. Now, by Emerson's Optics, p. 97, the sines of incidence and refraction out of air into water are as 529 to 396; wherefore $529 : 396 :: \sin. 89° 14' 35'' : \sin. 48° 27' 44''$, the angle of refraction, which, by hypothesis, is equal to the angle a diagonal makes with the side of the vessel. Conseq. the cosine $48° 27' 44'' : \sin. 48° 27' 44'' :: 8 : 9.0303$. the diameter of the vessel; hence we have $9.0303^2 \times .7854 \times 8 = 512.3718$ cubic inches, or $.238$ of a bushel, its content.

The same answered by Mr. O. G. Gregory, Yaxley, Hunts.

In the solution of this very pleasing question, it may be proper to consider at what time the sun rises on the given day, in the latitude of $52° 6'$ north, when the sun's declination was $7° 48'$ north, at 18 min. past 5 afternoon, under the meridian of Greenwich: for if the longitude be considerably westward of Greenwich (as the declination is decreasing) that here given will be too great; and, on the contrary, if the longitude be considerably eastward of that place, the time would anticipate that at Greenwich, and of course the declination here given would be too small.

To find the time of sun rise, say, as radius : tang. $52° 6'$ lat. :: tang. $7° 48'$ declin. : since $10° 8'$ ascensional difference, which divided by 15 gives $40\frac{8}{15}$ minutes, for the time the sun rises before 6 o'clock. Therefore $40\frac{8}{15}$ min. taken from 6 h. leaves 5 h. $19\frac{7}{15}$ min. the time of sun rise, which is so little different from the time given in the question, that we may without any material error substitute the one for the other.

The sun's apparent semidiameter on Sept. 2, is about $16' 8''$, at which height the refraction is, according to Sir Isaac Newton, $30'$ very nearly: hence, from the sum of $16' 8''$ and $30'$ take $8''$ the sun's parallax, the remainder is $46'$ apparent altitude of the sun's upper limb.

Newton has shewn in his Optics, that the light of the sun, which he calls heterogeneal light, consists of several kinds of rays, having different degrees of refrangibility: of which rays, the violet are most refrangible, and when refracted out of air into water, the sine of incidence is to that of refraction, as 109 to 81; the red are least refrangible, the sines of incidence and

refraction being as 108 to 81, or 4 to 3; and the refrangibility of the green rays is about the medium, the sines of incidence and refraction being as $108\frac{1}{2}$ to 81: which last proportion I shall here make use of.

Then, in the annexed figure, where EB is the path of the ray, refracted at B into the direction BD, and eBE = $90^\circ + 46' = 89^\circ 14'$; we have E$e$: Ff :: $108\frac{1}{2}$: 81. Hence Ff = nat. sine of $48^\circ 17' 8''$ = angle FBf. Then 8×1.1218059 (BC $\times$ tang. DBC) = 8.9744 = DC the diameter of the vessel, instead of $18\frac{1}{2}$ inches.
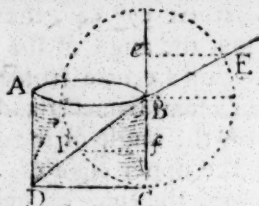
VI. DIARY QUESTION (989) answered by Mr. Wm. Robinson.

Let A$auoie$B be the semicircle, with the diameter of which AB as a radius describe the quadrant AC, which divide into any number of equal parts at the points S, S, &c. Draw the lines BS, BS, &c. and they will divide the semicircle into equal parts at a, e, i, &c; and draw the sines Sm. Sn, &c, perpendicular to AB, and they will be equal to the chords Ba, Be, Bi, &c, be-cause the triangles ABa and ABS are mutually similar and equal, and the same of the other corresponding triangles. This being premised, put x = the least sine Sm, r = AB (= 1 suppose); then $\sqrt{r-x^2}$ = cosine mB; and by Emerson's Trigonometry, pa. 73, cor. 3, we have $\dfrac{r^2 + r\sqrt{r^2 - x^2}}{x} = 4.297877$
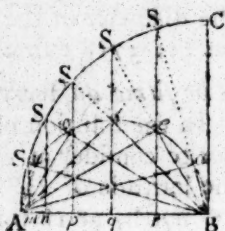
$+ 3.297877 = s$; from whence $x = \dfrac{2.2 s}{s^2 + r^2} = .2588190$, the

natural sine of 15°. Then $\dfrac{90^\circ}{.15} = 6$ the number of equal parts, and consequently 5 is the number of chords.

Now, to find the length of each chord, take the natural sine of 15°, 30°, 45°, 60°, 75°, and multiply them each by 100, the given radius AB or BC, and we get 25.88190, 50, 70.71068, 86.60254, and 96.5925, for the lengths of the five chords sought.

The same answered by Amicus.

It is pretty readily seen, that the number of divisions must not exceed 6, and trying that number, or, the chords of 30°, 60°, 90°, 120°, 150°, to the radius 50, will be equal to the sines 15°, 30°, 45°, 60°, and 75°, to the radius 100, and the sum of these taken from the tables is 329.7877, which added to the diameter is the specified number.

VIII. Diary Question *answered by Mr. Geo. Baron,* *Teacher of Mathematics, South Shields.*

Because the areas of circles are as the squares of their diameters, $.7854 : 80 :: 1 : 101.85$, hence $\sqrt{101.85} = 10.092$ = the diameter of the section. Also because the heights of similar cones are as the diameters of their bases, $12 : 10.092 :: 10$: 8.41 = height of the part immersed in water; then $\dfrac{80 \times 8.41}{3}$

$= 224.26$ solid inches = the content of the water displaced by the part of the cone, the weight of which by a hydrostatical property is equal to the weight of the whole cone. Now a cubic inch of water is known to weigh $.5787$ oz. avoirdupoise; hence by proportion, as $1 : 224.26 :: .5787 : 129.779$ oz $= 8.111$ lb, the weight of the whole cone required.

XI. Diary Question *answered by Mr. Wm. Burdon,* *Acaster Malbis.*

Since the area of the triangle is to the square of the base, in the given ratio of 1 to 12, and the base being given, therefore the area is given, and consequently the perpendicular CD $=$ $\frac{1}{6}$AB *(fig. 1 Diary)* is given. By the question $AC^2 + BC^2$: $AC^2 - BC^2 :: 13 : 12$, and by composition and division AC^2 : $BC^2 :: 25 : 1$, and $AC : BC :: 5 : 1$, the given ratio of the sides; and hence the problem is reduced to the 23d of Simpson's Algebra, pa. 36, or the 13th of his Geom. pa. 220, 4th edit.

The same answered by Mr. W. Watts, of Penzance.

Let x and y represent the sides of the triangle ABC *(fig. 1 Diary)*. Then, by the question $x^2 + y^2 : a^2 - y^2 :: 13 : 12$; hence $x^2 = 25y^2$, and $x = 5y$. Again, because $\frac{1}{2}$AB $\times$ CD = the area, and by the question $\frac{1}{2}$AB $\times$ CD : $AB^2 :: 1 : 12$, therefore CD $= \frac{1}{6}$AB $= \frac{1}{6}b$, putting b = the base AB. Put also $z = $ AD $-$ DB, then AD $= \frac{1}{2}b + \frac{1}{2}z$, and BD $= \frac{1}{2}b - \frac{1}{2}z$; hence $AC^2 = \overline{\frac{1}{2}b + \frac{1}{2}z}|^2 + \frac{1}{36}b^2$, and $BC^2 = \overline{\frac{1}{2}b - \frac{1}{2}z}|^2 + \frac{1}{36}b^2$; therefore, as above, $\overline{\frac{1}{2}b + \frac{1}{2}z}|^2 + \frac{1}{36}b^2 : \overline{\frac{1}{2}b - \frac{1}{2}z}|^2 + \frac{1}{36}b^2 ::$ $25 : 1$, which reduced gives this equation $z^2 - 1\frac{3}{4}z = -\frac{1}{9}b|^2$; hence $z = \frac{5}{6}b$; then AD $= \frac{11}{12}$AB, BD $= \frac{1}{12}$AB, AC $=$ $\frac{5}{12}$AB$\sqrt{5}$, and BC $= \frac{1}{12}$AB$\sqrt{5}$.

XII. Diary Question *answered by Mr. O. G. Gregory.*

Mr. Hodgson, in his Fluxions, pa. 438, finds the distance of the centre of oscillation from the vertex of a cone $= \frac{4}{5}$ axis: and in any compound pendulum, the distance of this centre from the point of suspension, is equal to the length of a simple pendulum whose oscillations are isochronal with those of the compound one. Let n be put for the axis of the cone, or for the number of oscillations in a minute; then, by Dr. Hutton's Mathematical and Philos. Dictionary, pa. 269, vol. 1, $\dfrac{140850}{nn}$ is the

distance of the centre of oscillation from the point of suspension; therefore $\frac{140850}{nn} = \frac{4}{5}n$, from which $n = \sqrt[3]{176062\cdot5} = 56\cdot0473$, the axis required. And by this method, the axis would be the same, to any dimensions of the base whatever.

But in the work last mentioned, $\frac{4}{5}$ axis $+ \dfrac{\text{radius base}^2}{5 \text{ axis}}$ is truely given for the distance of the centre of oscillation from the axis of suspension; therefore, if the radius of the base be denoted by r, we shall have $\frac{4}{5}n + \dfrac{r^2}{5n} = \dfrac{4n^2 + r^2}{5n} = \dfrac{140850}{nn}$, from which, by reduction, $n^3 + \dfrac{r^2 n}{4} = 176062\cdot5$. Here if r be 6 inches, we shall have $n = 55\cdot9939$ for the axis of the cone. And if the radius be chosen larger, the value of n will differ still more from $56\cdot0473$, its value by the first method.

The same answered by Mr. John Rutherford, of Wearshead.

Let $a = 39\cdot2$ the length of the pendulum that vibrates seconds, x the height of the cone in inches, $y =$ radius of its base, and $b = 60''$. Then $\dfrac{4xx + yy}{5x}$ (by Simpson's Fluxions,) is the distance of the centre of oscillation, and $\sqrt{\dfrac{4xx + yy}{5ax}}$ the time of one vibration. Therefore, as $\sqrt{\dfrac{4xx + yy}{5ax}} : 1 :: b : x$, and hence $x\sqrt{\dfrac{4xx + yy}{5ax}} = b$. Now in this equation there are two unknown quantities, and as nothing is given in the question by which y may be exterminated, innumerable answers may be obtained, according as y is assumed. If y be taken $= 5$, then $x = 56\cdot046$, &c.

XIII. Diary Question *answered by Mr. Rd. Elliott, Liverpool.*

The given equation being $y^4 + 6\frac{2}{3}y^3 + 14y^2 - 12y - 51 = 0$, or in general $y^4 + ay^3 + by^2 - cy - d = 0$, we have by Simpson's rule $k(\frac{1}{4}ac - d) = -71$, $l(\frac{1}{4}c^2 + d \times \overline{\frac{1}{4}a^2 - b}) = 183\frac{4}{5}$, and the cubic equation $A^3 - \frac{1}{2}b A^2 + kA - \frac{1}{2}l = A^3 - 7A^2 - 71A - 91\frac{2}{3} = 0$. Put $A = x + \frac{7}{3}$, in order to destroy the 2d term; then the equation, when reduced, becomes $27x^3 - 2358x = 7634$, or $y^3 - 786y = 7634$, by making $x = \frac{1}{3}y$. Now it is demonstrated in the Ladies' Diary for 1790, by Amicus, that in any equation of this form ($y^3 - ay = m$), where the co-efficient of y (a) and the absolute number (m) are integers, that the equation in certain circumstances has no ratio-

nal root: where he makes $y = \dfrac{m}{p}$, and by fubftitution the

equation becomes $\dfrac{m^2}{p^2} - p = a$. He then clearly proves that p

muft be an integer, and confequently fome divifor of m, to have the equation poffible, as p and a are integers. Hence, applying

this to the above, we have $\dfrac{7634^2}{p^2} - p = 786$, where by try-

ing the values of p when $\dfrac{7634}{p}$ is an integer (as it muft be)

none will anfwer; therefore the equation has no rational root, and of courfe the value of a is irrational, which alfo happens in many other equations; and as Dr. Hutton juftly obferves in his Math. and Philof. Dictionary, that " the inftances in which it holds true, are very few indeed, in comparifon with the number in which it fails."

XIV. DIARY QUESTION anf. by Mr. Cullen O'Connor.

As action and re-action are equal and contrary, the momentum of the ball and the elaftic fluid generated by the firing of the gunpowder, moving forward, is at all times equal to the momentum of the gun, &c. backward; therefore the velocities of thefe are always inverfely as their quantities of matter, and confequently the fpaces defcribed by each are in the fame conftant ratio, viz. inverfely as the quantities of matter. But the quantity of matter in the gun may be confidered as 4800 + 2400 + 3600 = 10800, the weight of the ball 18, of the powder 4; but the motion of the inflamed powder muft be eftimated from that of its centre of gravity, which, being in the middle, moves but with half the velocity of the ball, which will be equivalent to taking half the weight, and double the velocity, or that of the ball; hence the quantity of matter moving forward may be confidered as 18 + 4 = 22; omitting the fmall quantity of the fluid which expands with the recoil of the gun, as of no fenfible effect in this cafe. Alfo, the whole fpace moved forward when the centre of the ball arrives at the muzzle of the gun, is 108 − 13 − 2·565 = 92·435. Hence then, as 10800 : 22 :: 92·435 : ·188 of an inch, the recoil of the gun required.

Note, Had the inflamed powder been confidered as moving with the whole velocity of the ball, inftead of the half of it, this recoil would have come out = ·222, or $\frac{2}{9}$ of an inch nearly.

XV. DIARY QUESTION anfwered by Clericus, Southwold.

As the matter of the propofed aerial fphere is fuppofed to poffefs the well known properties of our atmofpheric air, which confift of being fubject to the common laws of gravitation, and to acquire a denfity in the direct proportion to the force impreffed; it thence follows, that if A, B, C, be affumed three

invariable quantities, the denfity of the propofed fphere, at x diſtance from its centre, will be Ax^{-2}; the quantity of matter incloſed within that diſtance, will be Bx; and the force of gravitation, will be Cx^{-1}.

To prove which, and at the ſame time to determine the values of A, B, C, in given terms; let unity (1) repreſent both the force of gravity, and denſity of the air, at the earth's ſurface. Put $r = 3977$ miles, the radius of the earth; $m = 3825$ the mean denſity of the earth; $b = \frac{60}{11}$ miles nearly, the height of a homogeneous atmoſphere, whoſe denſity is 1, and preſſure at the earth's ſurface, equal to that of our atmoſphere in its mean ſtate. Alſo let $p = 3.141592$, &c, and $E = \frac{4}{3}pr^3m$, the quantity of air (denſity $= 1$) which is equivalent to the quantity of matter in the earth. Then if D be the denſity at x diſtance from the centre; M, the quantity of air of the ſame kind with E, incloſed within that diſtance; and F the correſpondent force of gravitation; we have, by Pneumatics, $b\dot{D}$ (the fluxion of the preſſure) $= F \times D \times -\dot{x}$. Now $\dot{M} = 4px^2\dot{x} \times Ax^{-2}$

$(\dot{D}) = B\dot{x}$, theref. $B = 4pA$. Again, $\dfrac{E}{r^2} : \dfrac{M}{x^2} \left(= \dfrac{B}{x}\right) =$

$\dfrac{4pA}{x} :: 1 : F = \dfrac{4pr^2A}{Ex}$. Whence $b\dot{D} = - \dfrac{4p^2A^2x^{-3}\dot{x}}{E}$, or

$D = \dfrac{2p^2A^2x^{-2}}{bE}$, which ſhews that D was rightly aſſumed.

And therefore $\dfrac{2p^2A^2}{bE} = A$; or $A = \dfrac{bE}{2pr^2} = \dfrac{2brm}{3}$; $B =$

$\dfrac{8pbrm}{3}$; and $C = \dfrac{4pr^2A}{E} = 2b$. Whence,

denſity $= \dfrac{2brm}{3x^2}$; force of gravitation $= \dfrac{2b}{x}$; and $M = \dfrac{8pbrmx}{3}$.

Cor. 1. When $D = 1$, $x = \sqrt{\frac{2}{3}brm} = 7438$ miles, the diſtance from the centre of the aërial ſphere, where the denſity equals that of the air at the earth's ſurface.

Cor. 2. Let $D = m$; then $x = \sqrt{\frac{2}{3}br} = 120$ miles, the diſtance where the ſaid ſphere hath its original denſity.

Cor. 3. When $M = E$, or $\frac{8}{3}pbrmx = \frac{4}{3}pr^3m$; then $x = \dfrac{r^2}{2b}$

$= 1440000$ miles nearly the radius of the whole aërial ſphere, containing matter equal to the whole earth.

Cor. 4. At about 11 miles diſtance from the centre, the force of gravitation is equal to that at the earth's ſurface.

N. B. The whole radius of the aërial ſphere, and alſo its

gravitating force throughout, continue the same, whatever may be the mean density (m) of the earth.

Cor. 5. Hence the quantity of matter contained within any given distance of the centre, is to the quantity, supposing the density to be invariable, thence to the centre, as 3 to 1. For as $D = \dfrac{2bmr}{3x^2}$; the quantity of matter in a sphere (radius $= r$)

of this density, is $= \dfrac{4px^3}{3} \times \dfrac{2bmr}{3x^2} = \dfrac{8pbmrx}{9}$, which is to M $= \frac{8}{3}pbmrx$ evidently $:: 1 : 3$.

Schol. We hence understand that, when a body or collection of air forms itself into a sphere by the mutual attractive and repulsive forces of the particles among themselves, independent of any other force, it does not extend itself *ad infinitum*, as is the case with the atmosphere of the earth. And moreover, should there be, as very probably there is, some fixed limit to the density of air; still if that limit lies comparatively near the centre, the sphere will yet extend only to a finite distance, whilst the whole quantity of matter is finite. This appears from the above example, where, supposing the density of water, for instance, to be the fixed limit to that of air; this lies only at 258 miles distance from the centre; and therefore (Cor. 5) the quantity of matter thence to the centre is only $\frac{25}{1+70000}$th part of the whole, which is inconsiderable.

NEW QUESTIONS.

I. Question (53) by *Agricola.*

A man had 10 sheep, which he kept until they were 10 years old; they brought him a ewe lamb every year, and each of those lambs, and their posterity, when one year old, brought forth a ewe lamb: then how many were the posterity of the 10 sheep, when 10 years old ?

II. Question (54) by *Mr. Wm. Pearson.*

A carpenter has a piece of tapering squared timber $9\frac{1}{2}$ feet long; the side of its greater base is 21 inches, and the side of its less base 9 inches; he desires to know how far from the greater end he must cut it, to take off 8 solid feet, measured in the common way, viz. the square of the quarter girt in the middle by the length.

III. Question (55) by *Mr. Tho. Elliott, Newcastle.*

A young gentleman has 1600l. left him, which he has put out at simple interest at 5 per cent. per annum, the interest yearly being 80l. But finding he requires 100l. a year to support him, he intends to take as much from the principal yearly

as the intereſt of that year falls ſhort of 100l. Query how long will the money laſt him?

IV. QUESTION (56) *by Mr. James Norland.*

Ye Britiſh Fair, whoſe powerful charms diſplay
A luſtre equal to the orb of day;
Tell, if you can, how long * that orb requires
To gild the north pole with his riſing fires.

* i. e. How long he is riſing to a ſpectator at the north pole.

V. QUESTION (57) *by the Rev. Mr. Ewbank, of Thornton-Steward.*

Required the weight of the atmoſphere, or the preſſure of the air, in tons, and in ſhip loads of 1000 tons each, upon the whole ſurface of the globe; ſuppoſing the preſſure of the air to be $14\frac{3}{4}$lb. on each ſquare inch, and the circumference of the globe of the earth 25000 miles.

VI. QUESTION (58) *by Mr. Iſaac Saul.*

A manufacturer ſells cloth at $13\frac{1}{4}$d per yard, and 6 months credit; but wiſhing to have a quicker return, propoſes to ſell the ſame goods at 13d per yard, and 3 months credit: what will be his gain or loſs per cent. per annum by ſo doing, ſuppoſing the cloth ſtood him in 12d per yard.

VII. QUESTION (59) *by Mr. E. Warren.*

Given the length $l = 50$ inches, of a ſlip of paper, and its thickneſs $t = $ 1-100th of an inch; to determine how many times it may be wound about a given cylinder of the diameter $d = $ half an inch.

VIII. or PRIZE QUESTION (60) *by the Rev. J. Furnaſs, of Heddon-on-the-Wall, near Newcaſtle.*

[*Whoever anſwers it before Candelmas-day, has a chance by lot for 10 Supplements.*]

Admit the earth to be a perfect ſphere, whoſe diameter is $7957\frac{3}{4}$ miles, or the circumference 25000 miles: Query the number of ſquare miles the eye may take in from the ſummit of a mountain, on which a clock, (that kept true time on the earth's ſurface), loſt one minute in a day?

⁂ The prize of 10 *Supplements for the ſolution of the Prize Queſtion has fallen to Mr. Wm. Marriot; and the prize of* 10 *Supplements alſo, for the ſolution of the Enigmas, Rebuſes, &c. to Mr. Ra. Burton, who will pleaſe to ſend for them to the publiſher.*

FINIS.